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BSR 4159

Laser Geodynamic Satellite Thermal/Optical/Vibrational Analyses and Testing

Final Report

Volume II
Technical Report

Book 2

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Contract NAS 8-30658

October 1974

Prepared for:

George C. Marshall Space Flight Center
National Aeronautics and Space Administration
Marshall Space Flight Center, Alabama 35812

Bendix Aerospace Systems Division

Ann Arbor, Michigan

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VOLUME II

BOOK 2

This Book 2 of Volume II contains only Appendix Q.

APPENDIX Q

11 SEPTEMBER 1974

LASER GEODYNAMIC SATELLITE (LAGEOS)

THERMO-OPTICAL ANALYSIS

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Prepared for

Bendix Aerospace Division
3300 Plymouth Road
Ann Arbor, Michigan 48107

In response to contract No. T2997

Itek Optical Systems Division
ITEK CORPORATION • 10 MAGUIRE ROAD • LEXINGTON, MASSACHUSETTS 02173

FOREWARD

This final report, prepared by Itek Corporation, Lexington, Massachusetts under contract No. T2997 to Bendix Aerospace Systems Division, Ann Arbor, Michigan, covers work performed from May 3, 1974 to August 30, 1974 under the direction of Bendix Aerospace. The Bendix project manager was Mr. John M. Brueger and the thermal engineer was Mr. Eric Granholm.

The following Itek personnel were the primary contributors to the work summarized in the report:

Project Manager	M. Kahan
Lead Optical Engineer	R. Byrd
Lead Optical Analysist	M. Rimmer
Polarization Computations	J. Meiron

The report documents the performance as well as the sensitivity of an uncoated LAGEOS cube-corner retroreflector under a number of different thermal and manufacturing conditions for use in comparison with Bendix test data. Conclusions and recommendations for possible future work are also provided.

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ACKNOWLEDGEMENT

Our appreciation is provided to Bendix Aerospace for the opportunity to review our data with Mr. David Arnold of the Center for Astrophysics/Smithsonian Observatory. Mr. Arnold was quite helpful to us during both the review and analysis cycles of our activity and his support deserves special recognition.

ABSTRACT/SUMMARY

The purpose of this Itek Corporation LAGEOS Contract was to analytically demonstrate the quality of a retro-reflected laser signal's far field diffraction pattern. This information would be one of several inputs which would be used by Bendix Aerospace, NASA and SAO in configuring a Laser Geodynamic Satellite to accurately establish the physical motions and distortions of the solid earth. The overall effort was conducted as a part of the Earth and Ocean Physics Application Program (EOPAP).

The main tasks performed by Itek involved the modelling, over field angle, of an individual suprasil cube-corner having potential manufacturing variations (e.g. surface quality and angular anomalies) and environmental loadings. The far field characteristics included polarization effects and treated both far field patterns and encircled energy data. Thus, the energy in the 32-42 μradian annular region was tabulated as an indicator of performance sensitivity as this was roughly the region where comparable Bendix Aerospace test data was taken.

The results are provided rather succinctly in appendix C in viewgraph form. Given no reflection or absorption losses a 1.5 arc-sec cube returned 21.6% of the incident energy on-axis and 10.8% at -15° off-axis in the annulus of interest. The retroreflector's encircled energy data was relatively insensitive to irregular dihedral angle errors and surface quality effects. However, up to 6.8% changes in annular energy (e.g. 22% to 14%) were noted when all dihedral angles were simultaneously offset in the same direction by 0.5 arc-sec. The 3-D temperature profile analyzed changed the annular return only about 1%. Finally, the axial thermal gradients were found to conpensate the radial gradients-the individual gradient types having fairly high sensitivity. In no case which was analyzed to simulate actual cube performance (as opposed to pure sensitivity determinations) did the annular return drop to 50% of that of the nominal cube--the criterion supplied us to assess degradation severity.

Future work suggested includes a more detailed comparison of the differences between various theoretical and experimental results for the specific cube geometries and test configurations of interest. This might help to further optimize the cubes.

Also, an additional treatment of field angle/polarization inputs may prove desireable. Eventually, an evaluation of performance at shorter wavelengths and of cube-corner arrays could be provided.

INTRODUCTION

This report is submitted by Itek Corporation's Optical Systems Division in accordance with the requirement of contract T2997 to furnish a detailed analysis of a fused silica cube-corner retroreflector. This analysis has included the effects of manufacturing errors and temperature variations, which may affect the performance of the cube-corner retroreflector.

Figure 1 illustrates the process used in the cube-corner performance study. A perfect cube corner (90° angles) was analyzed to confirm computer modeling. A specified +1.5 sec wedge on each dihedral angle was then modelled and its effect noted. The effect of manufacturing error and the effects of manufacturing error combined with various temperature profiles were then examined. Also analyzed were the effects of a non uniform wedge angle with manufacturing error and with a manufacturing/temperature profile combination.

Each portion of this study is presented in detail in the body of this report to illustrate the performance of the cube corner retroreflector.

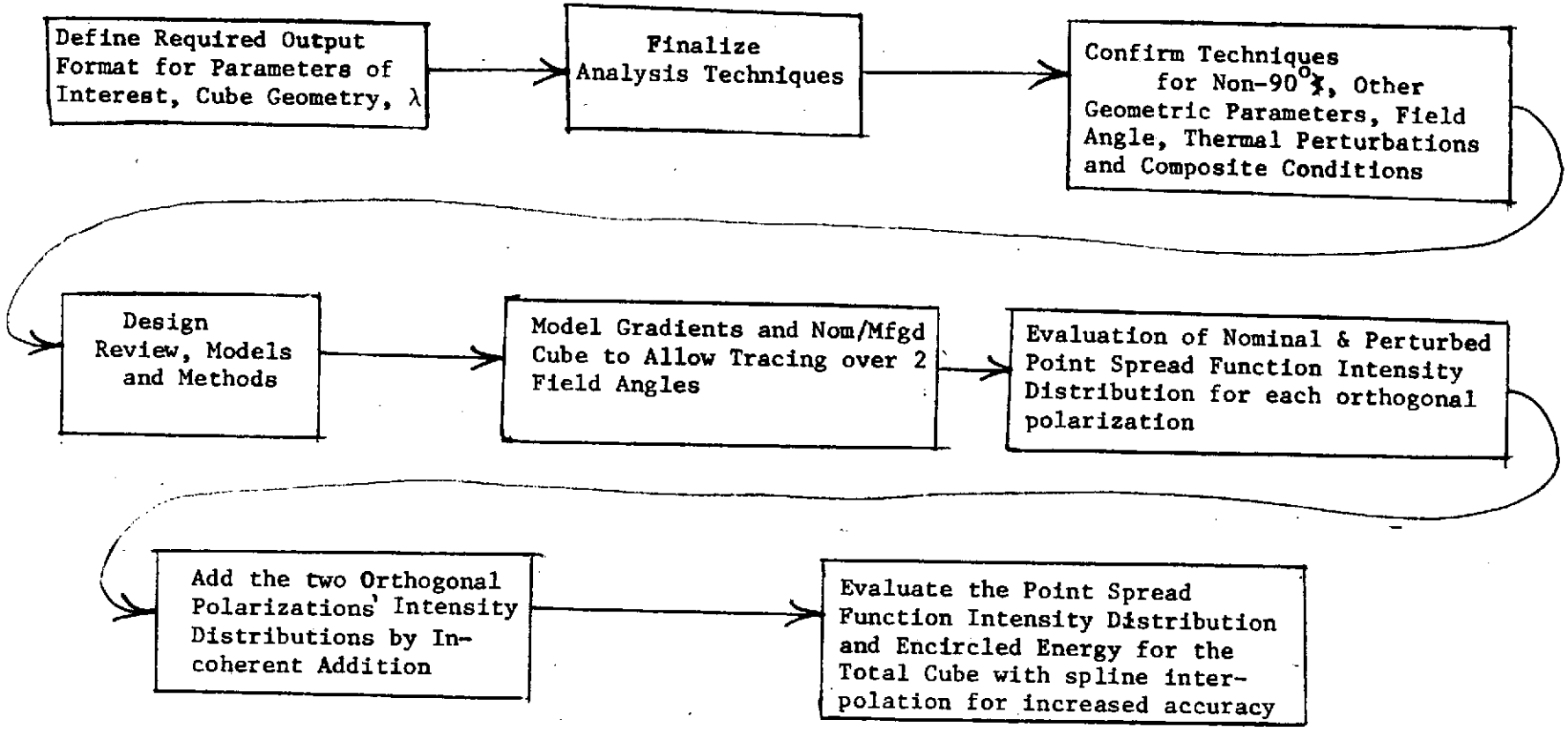
PROCEDURE

The retrodirective nature of the cube-corner reflector is well known. Each ray incident on the front face of a perfect reflector, is consecutively reflected by the three reflecting surfaces and leaves the reflector in a direction parallel to the incoming ray at a point diametrically opposite to its point of entry. The order in which the rays are reflected from the surfaces affects their polarization properties. Hence, a plane wave of given polarization incident on a perfect cube-corner, emerges as a multi component collimated beam of different polarizations (and amplitudes). For normal incidence, each of these beams originates at one of the sections bounded by the cube edges, their images in the reflecting surfaces and the margin of the aperture (see Figure 2).

In order to trace rays through a cube corner and compute the polarization changes the cube was modelled by means of three tilted plane surfaces. The different sequences of reflection in the reflector are achieved by varying the tilts of the three tilted plane surfaces. Each permutation allows only the beam of one particular sextant to emerge from the exit pupil of the system since rays outside the particular segment intersect one or more of the surfaces beyond the corner edges and are rejected by Itek's proprietory ray trace program (see Figure 1).

The sectors with their respective amplitudes and phases are then combined into

FIGURE 1
CUBE CORNER
PROCESS FLOW CHART



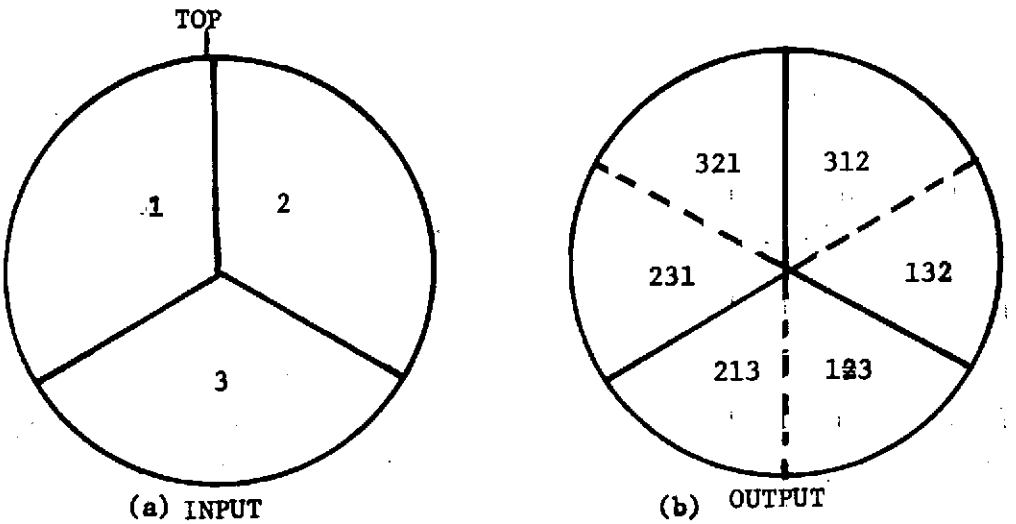


FIGURE 2

a. Front view of cube corner retroreflector with circular front face. Reflecting surfaces are labelled 1-3.

b. Sextants showing the sequence of reflections of the beam falling on the reflecting faces. Thus 132 indicates that light reflected by the surfaces in sequence 1, 3, and 2 will exit in the sextant noted.

one wavefront for each of the polarization components. The amplitudes and phases of the various sextants for a TIR cube-corner made of fused silica (λ= 6328Å, n = 1.457) are shown in Table 1 for both on axia and -15° off axis. The light was assumed to be plane polarized in the meridional plane (i.e. parallel to the real edge between surface 1 and surface 2 of Figure 2).

POLARIZATION EFFECTS

The procedure used to compute the polarization effects was to follow rays through the reflector, and to determine the amplitude and phase changes between orthogonal polarizations caused by total internal reflection. It was found that the amplitude and phase, or equivalently the complex amplitudes, have different values for different sextants.

It was assumed that the incident light was monochromatic and linearly polarized. A set of axes for the resolution of the electromagnetic vector $\underline{E}$ is shown in Figure 3.

The orthogonal sets of unit vectors $\underline{p}\ \underline{s}\ \underline{r}$ and $\underline{p}'\underline{s}'\underline{r}'$ are right handed, with r and r' the unit vectors in the ray direction, s and s' perpendicular to the plane of incidence and $\underline{p}$, $\underline{p}'$ in that plane. The vector $\underline{E}$ can then be represented by its two complex components E_s and E_p in the $\underline{s}$ and $\underline{p}$ directions*, eg.

$$\underline{E} = E_s \underline{s} + E_p \underline{p} \quad . \qquad (1)$$

If $\underline{n}$ is the unit vector of the normal to the optical surface, $\underline{s}$ and $\underline{p}$ can be determined from:

$$\underline{s} = \underline{r} \times \underline{n}/\sin\alpha \qquad (2)$$

$$\underline{p} = \underline{s} \times \underline{r}$$

where $\sin\alpha = \sqrt{1-(\underline{r}\cdot\underline{n})^2}$ and α is the angle of incidence.

---

* eg. the "P" and "Q", respectively, of Table 1.

TABLE 1

AMPLITUDE AND PHASE * OF ORTHOGONAL (P AND Q)

VECTORS EXITING FROM CUBE-CORNER RETROREFLECTOR

Reflection Order	Amplitude-P	Phase-P (radians)	Amplitude-Q	Phase-Q (radians)
INPUT	0.	0.	1.0	0.0
123	.76	-1.63	.66	2.78
132	.27	0.31	.96	-1.83
312	.76	-2.48	.66	2.78
321	.76	+0.90	.66	2.78
231	.27	+2.83	.96	-1.83
213	.76	1.52	.66	2.78

POLARIZATION -15° OFF AXIS

Reflection Order	Amplitude-P	Phase-P (radians)	Amplitude-Q	Phase-Q (radians)
INPUT	0.	0.	1.0	0.
123	0.88	1.70	.48	2.99
132	0.20	- .17	.92	1.91
312	0.88	-2.04	.48	2.99
321	0.88	1.10	.48	2.99
231	0.20	-3.31	.92	1.91
213	0.88	-1.45	.48	2.99

* A negative sign in phase indicates a leading wavefront.

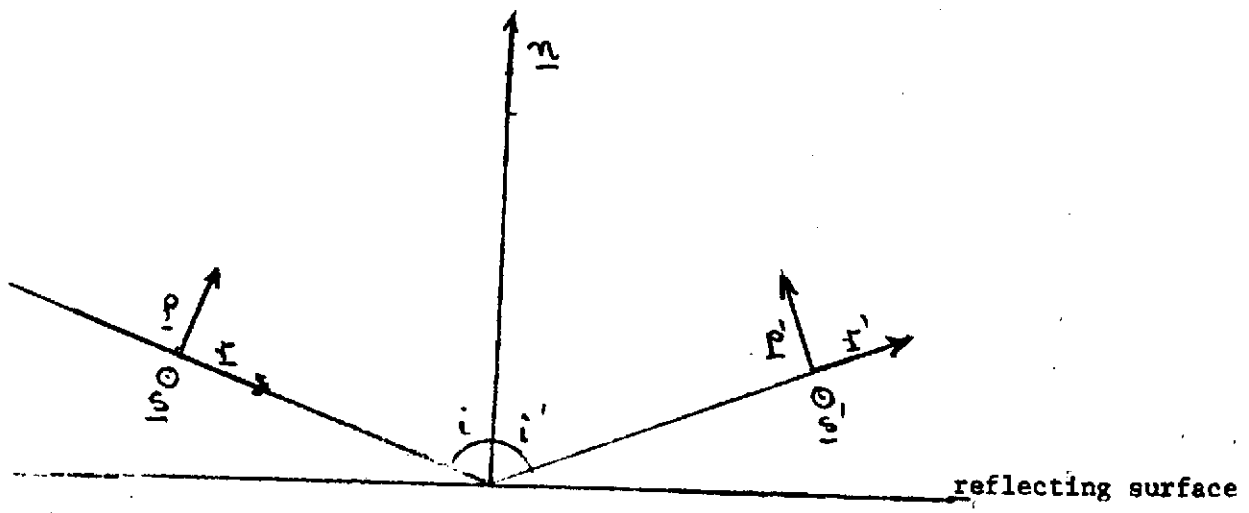


Figure 3. Coordinate axes at reflecting surface.

At each reflecting surface, k, the respective unit vectors $\underline{s}_k$ and $\underline{P}_k$ are determined and the new complex components E_{sk} and E_{pk} in these directions found from

$$(E_{sk}, E_{pk}) = C \begin{pmatrix} E_s \\ E_p \end{pmatrix} \qquad (3)$$

where C is the transformation matrix

$$C = \begin{pmatrix} \underline{s} \cdot \underline{s}_k & \underline{p} \cdot \underline{s}_k \\ \underline{s} \cdot \underline{p}_k & \underline{p} \cdot \underline{p}_k \end{pmatrix} \qquad (4)$$

Polarization phase shifts introduced by the total internal reflection can now be computed using well-known formulas of electromagnetic theory:

$$E'_{sk} = E_{sk} \frac{n \cos \alpha - i\sqrt{n^2 \sin \alpha - 1}}{n \cos \alpha + i\sqrt{n^2 \sin \alpha - 1}} \qquad (5)$$

$$E'_{pk} = E_{pk} \frac{\cos \alpha - in\sqrt{n^2 \sin \alpha - 1}}{\cos \alpha + in\sqrt{n^2 \sin \alpha - 1}}$$

where n is the refractive index of the corner-cube material. Since the complex coefficients of reflectance are of the form $e^{-2i\phi}$ we find that $|E'_{sk}| = |E_{sk}|$ and $|E'_{pk}| = |E_{pk}|$, ie., for each component only the phase is changed but not the amplitude.

Following reflection the unit vector $\underline{s}_k$ remains unchanged, however, the new $\underline{P}_k$ vector becomes

$$\underline{P}_k' = \underline{s}_k \times \underline{r}'_k$$

The emergent light is ultimately referred to the set of axes $\underline{s}_1$ and $\underline{p}_1$ of the ray incident on the front surface of the cube-corner reflector, and the combined polarization effect of the three total internal reflections is thus obtained.

EXPECTED DIFFRACTION PATTERNS

To confirm the validity of the Itek program the diffraction patterns of a plane wave of λ= 5145Å incident normally on a cube-corner of BK 7 glass (n = 1.52049) were calculated. The cube was considered to be uncoated, hence only total internal reflection took place. The light was assumed to be plane polarized in the meridional direction. Figure 4 is a computer generated plot of the iso-irradiance contour of the Q polarization while Figure 5 is a plot of the iso-irradiance contour of the P polarization. The contour plot of the total pattern which is the sum of the P and Q polarization is shown in Figure 6. In addition the diffraction pattern was calculated assuming the light to be plane polarized in the saggital direction. The iso-irradiance contours are the same as those in Figures 4, 5, and 6, rotated 180° degrees. Figure 7 shows the effect of total internal reflection on the polarization of the ray bundle. The contours for the saggital polarization agreed well with published data.*

PERFORMANCE - NOMINAL CUBE

Once the computer modelling agreed with published data the nominal cube was evaluated. The dihedral angles used in the analysis are shown in Figure 8 for both a nominal cube and an off nominal cube. The assumptions used in the analysis are shown in Table 2. The cube-corner was ray traced to determine the combined effects of polarization, dihedral angle variations and intensity variations on each orthogonal polarization of the wavefront. The amplitude variations across the wavefront for the Q and P polarizations respectively are shown in Figures 9 and 10 for the on-axis case and in Figures 11 and 12 for the -15 degrees off-axis case.

The amplitude variations of Figures 9 to 12 will be the same for all cases analyzed since they are dependent only upon the polarization and the input gaussian intensity variation. Some variation in polarization can occur with a different refractive index material but over the range of temperatures noted in this study the variation in index had a negligible effect on the polarization. The resultant phase variation across the aperture for the Q and P polarizations respectively are shown in printer maps (Figures 13 and 15) and wavefront plots (Figures 14 and 16) for the on-axis case. The intensity distribution for each polarization was then determined through the use of Itek's proprietory POINT program, which used the amplitude and phase of each polarization to get the normalized point spread function through a fourier transform. The intensity distributions were then added incoherently

* Chang, R.F., Currie, D.G., Alley, C.O. and Pittman, M.E. J. Optical Society of America, 61:431

Figure 4

Intensity Distribution

Q Polarization - On Axis

Perfect 90° Cube

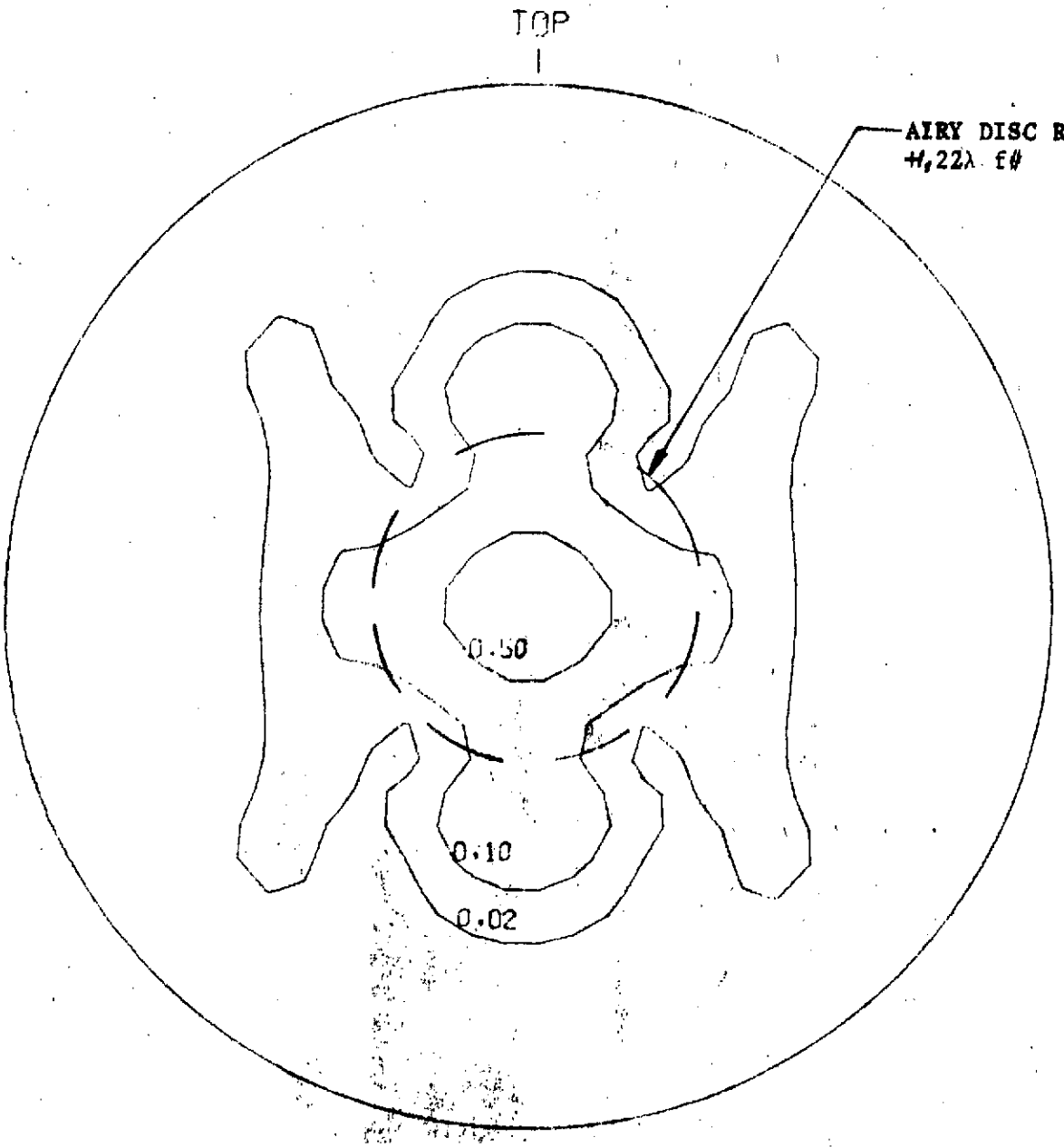


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Figure 5

Intensity Distribution

P Polarization – On Axis

Perfect 90° Cube

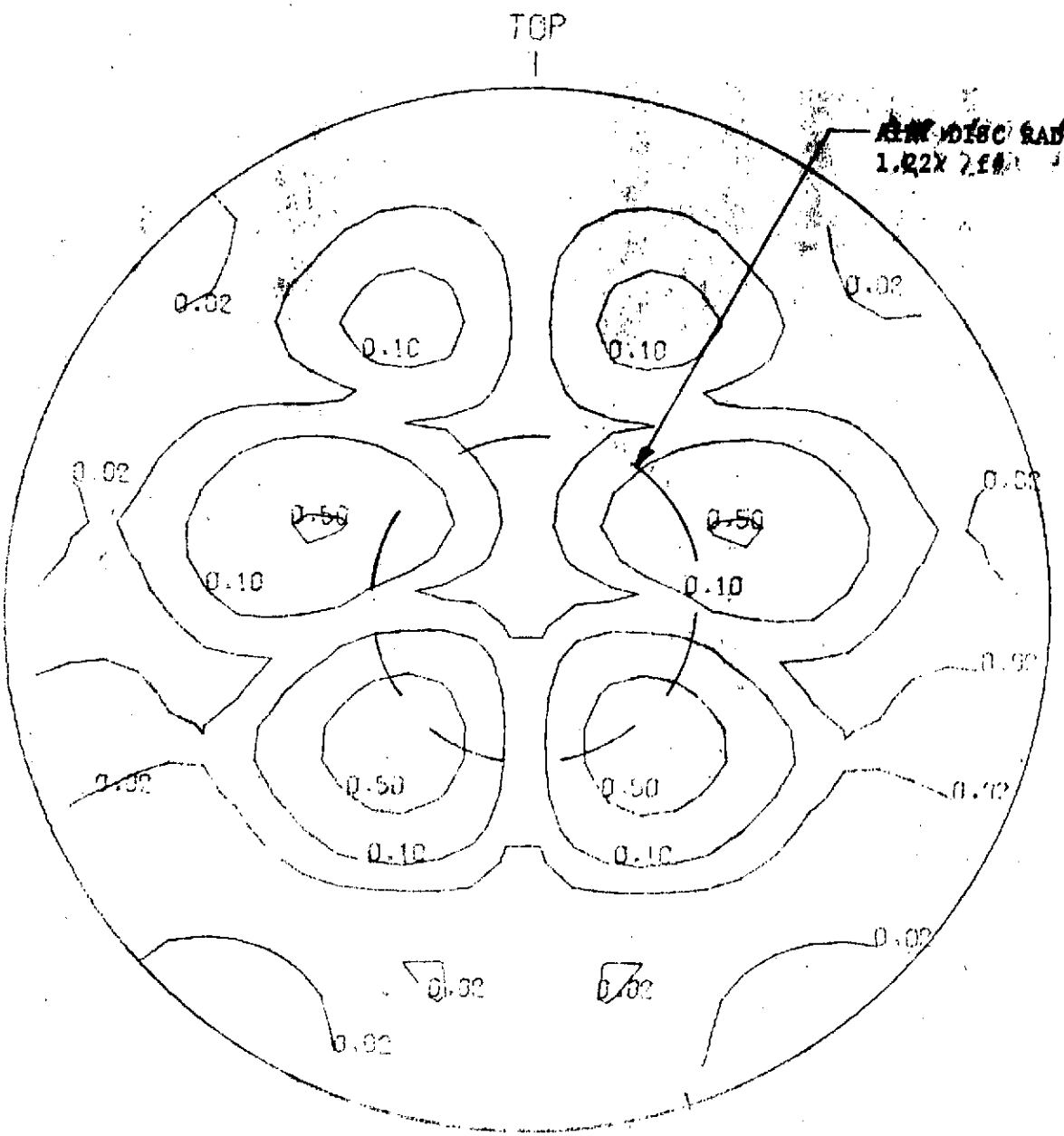

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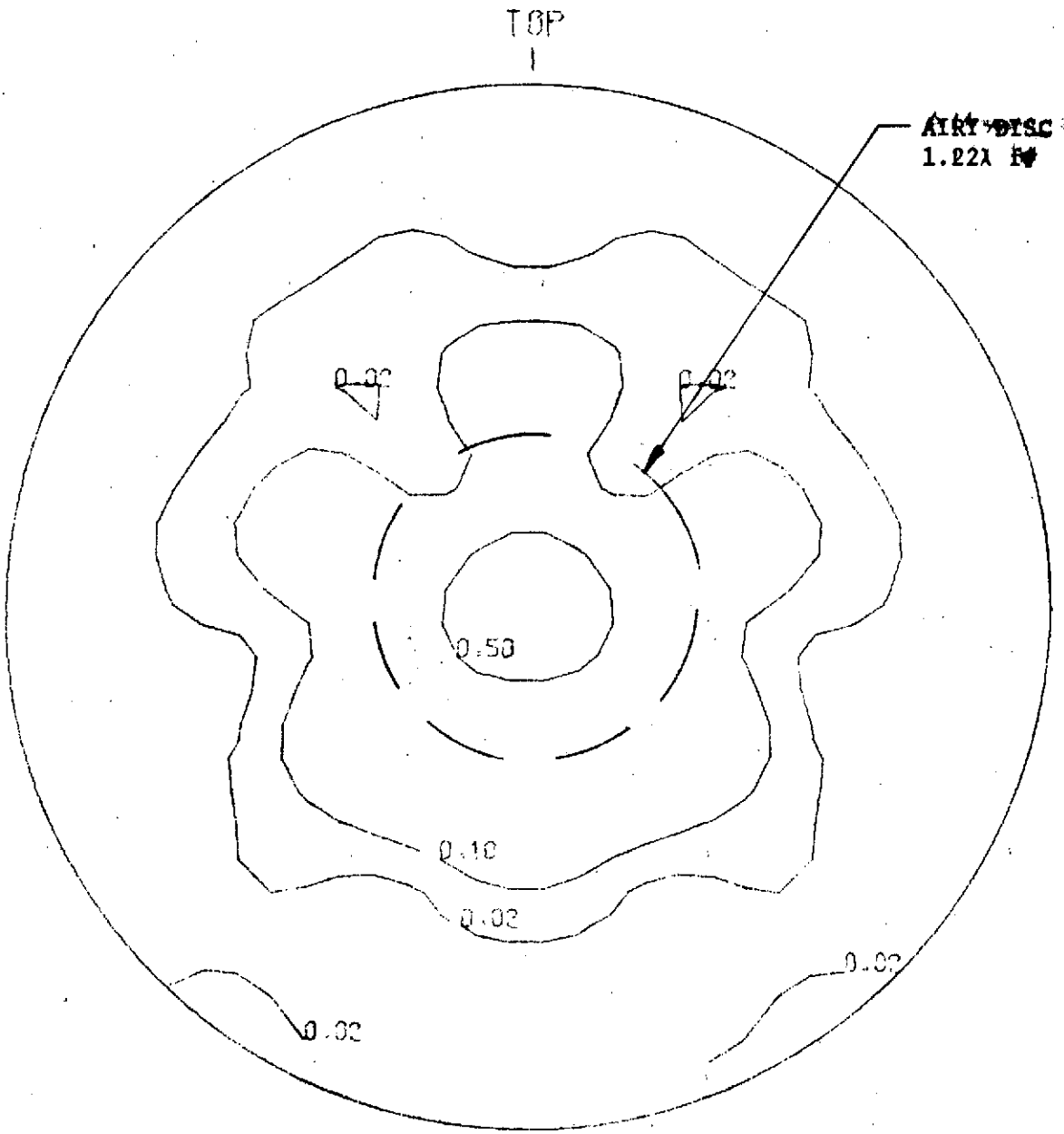
Figure 6

Intensity Distribution

Total Pattern

Perfect 90° Cube



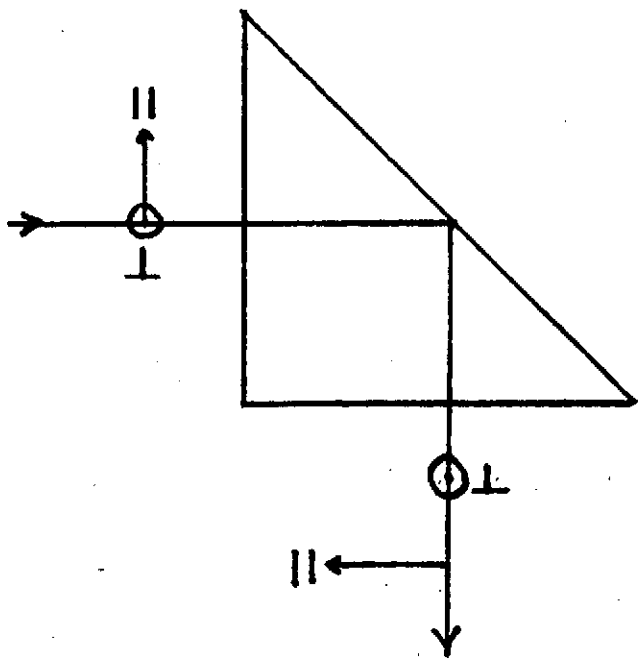
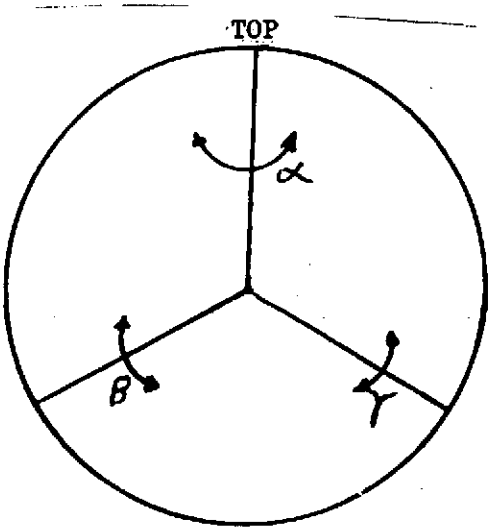


FIGURE 7

When linear polarized light is totally internally reflected the component perpendicular to the plane of incidence will exit lagging the component parallel to the plane of incidence. This will result in elliptically polarized light. In the cube corner there are three total internal reflections thus resulting in elliptically polarized light.

Figure 8

Dihedial Angles Used In Analysis of Cube Corner Retroreflector



	Nominal Cube	Off Nominal Cube
α	90° + 1.5 sec	90° + 1.5 sec
β	90° + 1.5 sec	90° + 1.0 sec
γ	90° + 1.5 sec	90° + 2.0 sec

TABLE 2

Assumptions/Specifications for LAGEOS Thermal-Optical Analysis

Number	Parameter	Data	Reference(s)
1.	Material	T-19 Suprasil 1 (special)	SOW 2.1 Table 1, No. 12, 4/30/74 letter; Amersil Catalogue EM-9227-1, 6/5/74 Amersil DN/DT Data; AIP Handbook.
2.	Geometry:		
	a) Face Diameter	38.10mm (1.500")	SOW 2.1.1, Fig. 2, Section A-a; Telecon, MK/EG,* 6/11/74
	b) Face Shape	Circular, Concentric with axis	SOW 2.1.1, Fig. 2
	c) Diherdral Angles	See Figure 8, text	Fig. 2 and clarify TELECONS of 6/3 to 6/11/74.
	d) Bevels	0.20mm max.	Fig. 2
	e) Face to Apex (solid)	27.93mm (1.100")	Fig. 2; 4/30/74 Letter, Table 1, No. 12
	f) Mount I.D.	38.48mm (1.515")	Telecon, MK/EG, 5/23/74
	g) Mount Extension Beyond Face	1.00mm	Telecon, MK/EG, 5/23/74
3.	Manufacturing Variations (as appropos).		
	a) Peak	$\lambda/4$ total effect for each sextant of emitted wavefront over 90% of sextant's area	SOW 2.1.1, Fig. 2 and 4/30/74 Letter - Table No. 2
	b) Shape	Random but smooth 1.5 bumps/segment, rolled edge not consistently present and thus not appropriate	ZYGO info. of 6/3/74; Telecon MK/JB* 6/11/74
	c) Max Peak Error per segment	0.278λ	Telecon, MK/JB, 6/10/74

* MK = Mr. Mark Kahan (Itek), EG = Mr. Eric Granholm (Bendix), JB = MR. Jonathan Brueger (Bendix)

TABLE 2, CONTINUED

Number	Parameter	Data	Reference(s)
4.	Optical Orbital Characteristics	Stationary	SOW 2.2 and 4/30/74 Letter, Table 1 No. 4
5.	Temperature	25°C, Uniform	Telecon, MK/EG, 6/3/74
6.	Laser		
	a) Wavelength	6328Å	SOW 2.4.1
	b) Diameter	50mm	SOW 2.2.2
	c) Intensity Uniformity	Gaussian Variation of 20% over 50mm diameter	SOW 2.4.3
	d) Incident Quality	Flat	SOW 2.4.4 and 4/30/74 Letter, Table 1, No. 6
	e) Position	Centered on cube axis	Telecon, MK/JB, 6/11/74
	f) Polarization	Linear as per Table 1, text	SOW 2.4.5
	g) Type	CW	4/30/74 Letter, Table 1, No. 12
7.	Field Angles	0° - 15° SOW Fig. 1 of SOW	PRO1166
8.	Vacuum	Under 10^{-6} torr	SOW 2.5.1
9.	Coatings	None	4/30/74 Letter, Table 1, No. 12

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FIGURE 9

Task 2.1 – Nominal Cube-On Axis

Amplitude Map–Q Polarization

Top Typ.

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                                                61 61 61 62 62 62 62 61 61 61
                                        61 61 62 62 62 62 62 62 62 62 62 62 62 62 62 61 61
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                   90 91 92 92 93 93 94 94 94 64 65 65 65 65 65 65 65 65 65 65 64 94 94 94 93 93 92 92 91 90
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                                  61 62 62 62 62 62 62 62 62 62 62 62 62 62 62 62 62 62 62 61
                                     61 61 62 62 62 62 62 62 62 62 62 62 62 62 62 62 61 61
                                                61 61 61 62 62 62 62 61 61 61
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FIGURE 10

Task 2.1 - Nominal Cube-On Axis

Amplitude Map-P Polarization

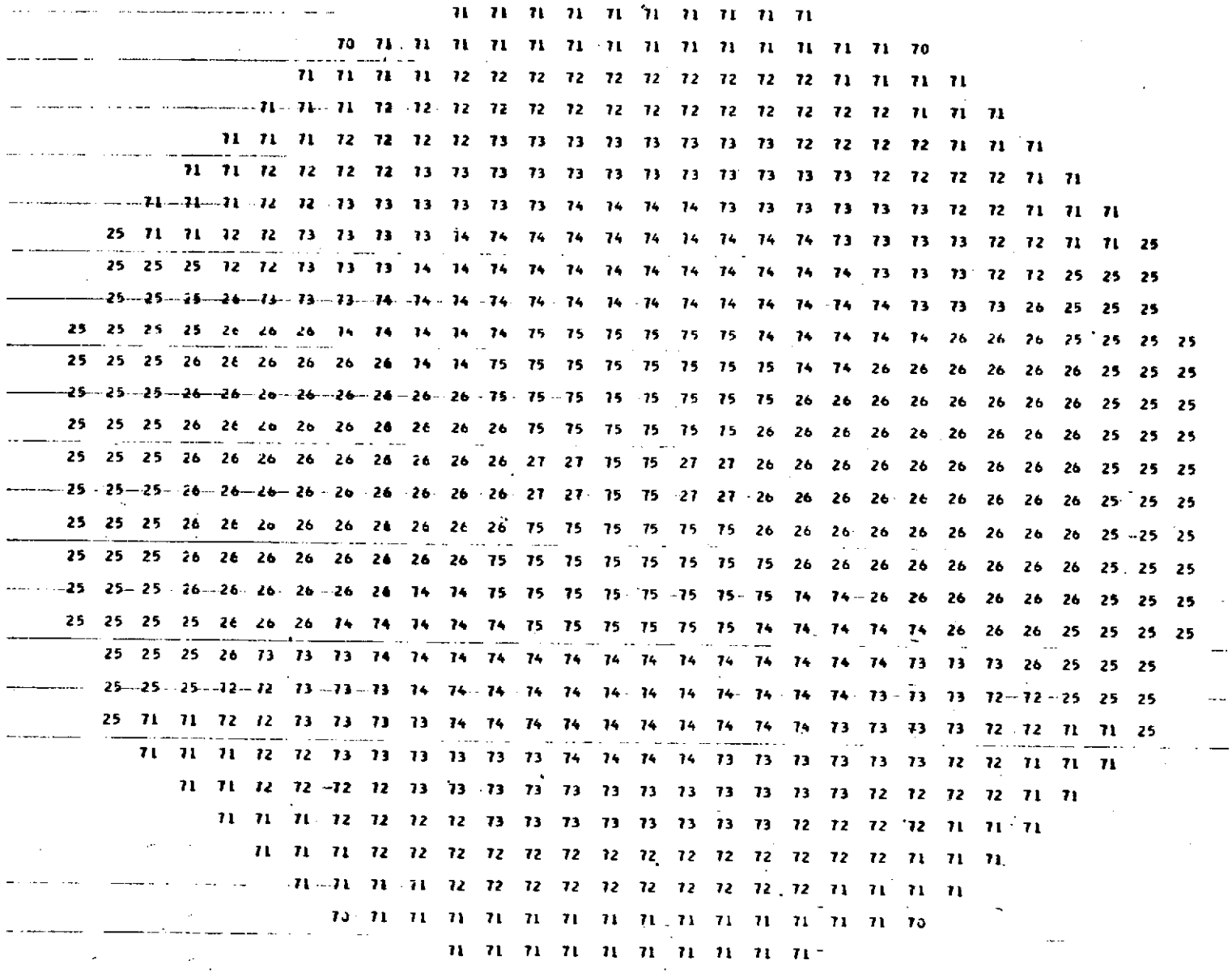

FIGURE 11

Task 2.1 - Nominal Cube -15° Off Axis
Amplitude Map-ϕ Polarization

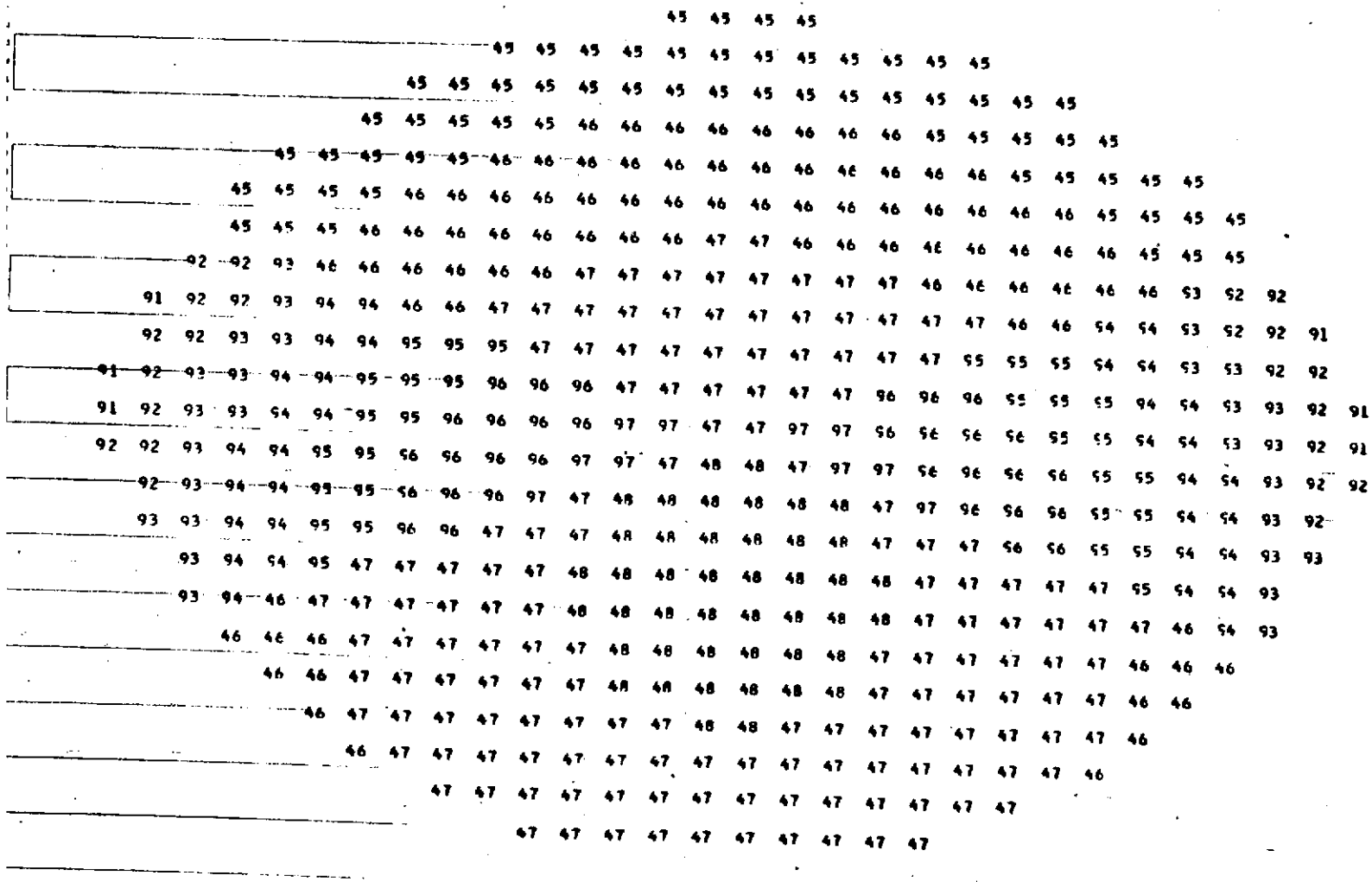

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FIGURE 12

Task 2.1 - Nominal Cube -15° Off Axis
Amplitude Map-P Polarization

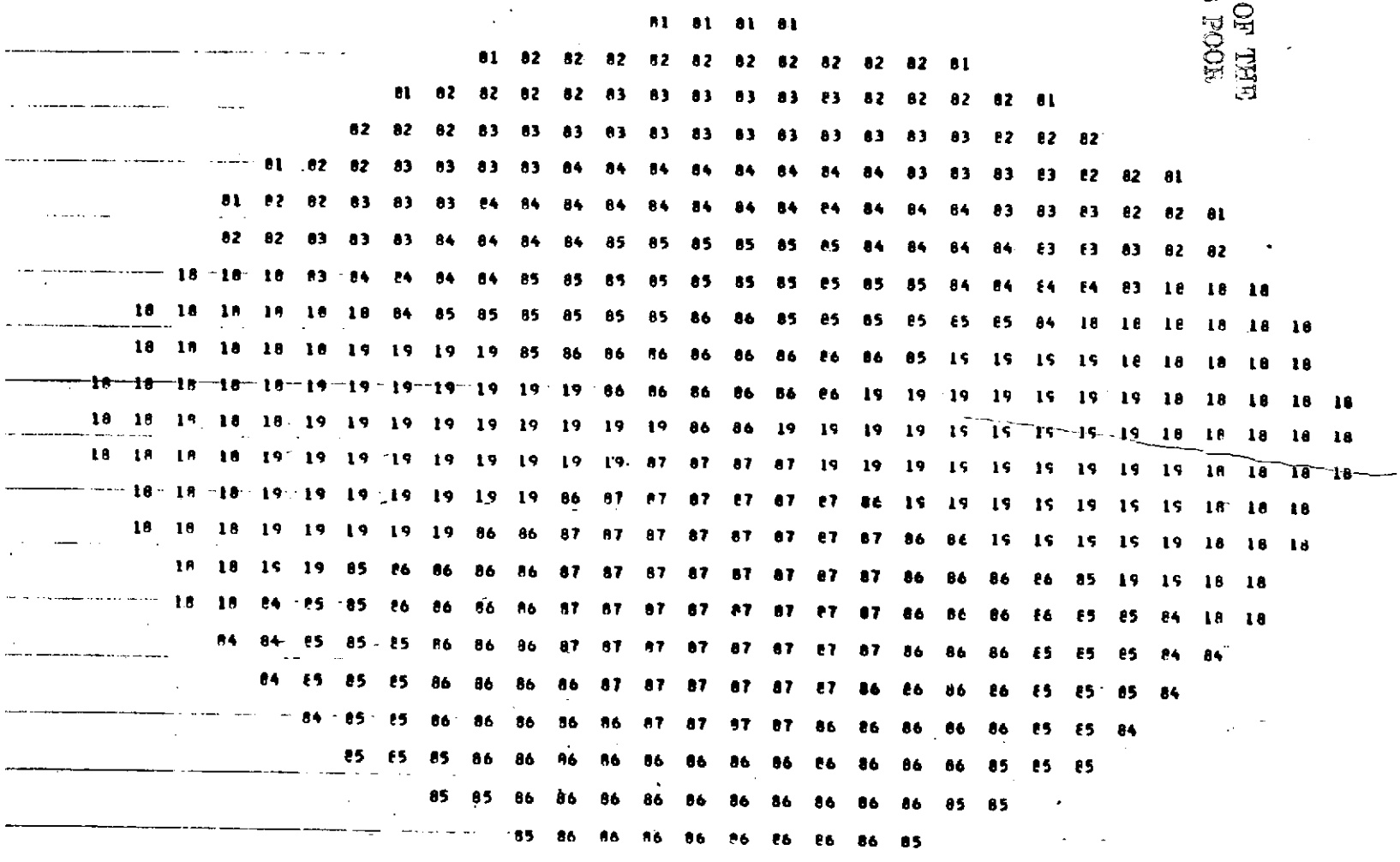

FIGURE 13

Task 2.1 - Nominal Cube-On Axis
Wavefront Map-0 Polarization

Top, Typ.

| | | |

SDD AVERAGE AVERAGE
1
NONE RMS 0.42 PK-PK 1.66 FRED WAVEFRONT

FIGURE 14

Wavefront Plot-Q Polarization

Task 2.1 - Nominal Cube-On Axis

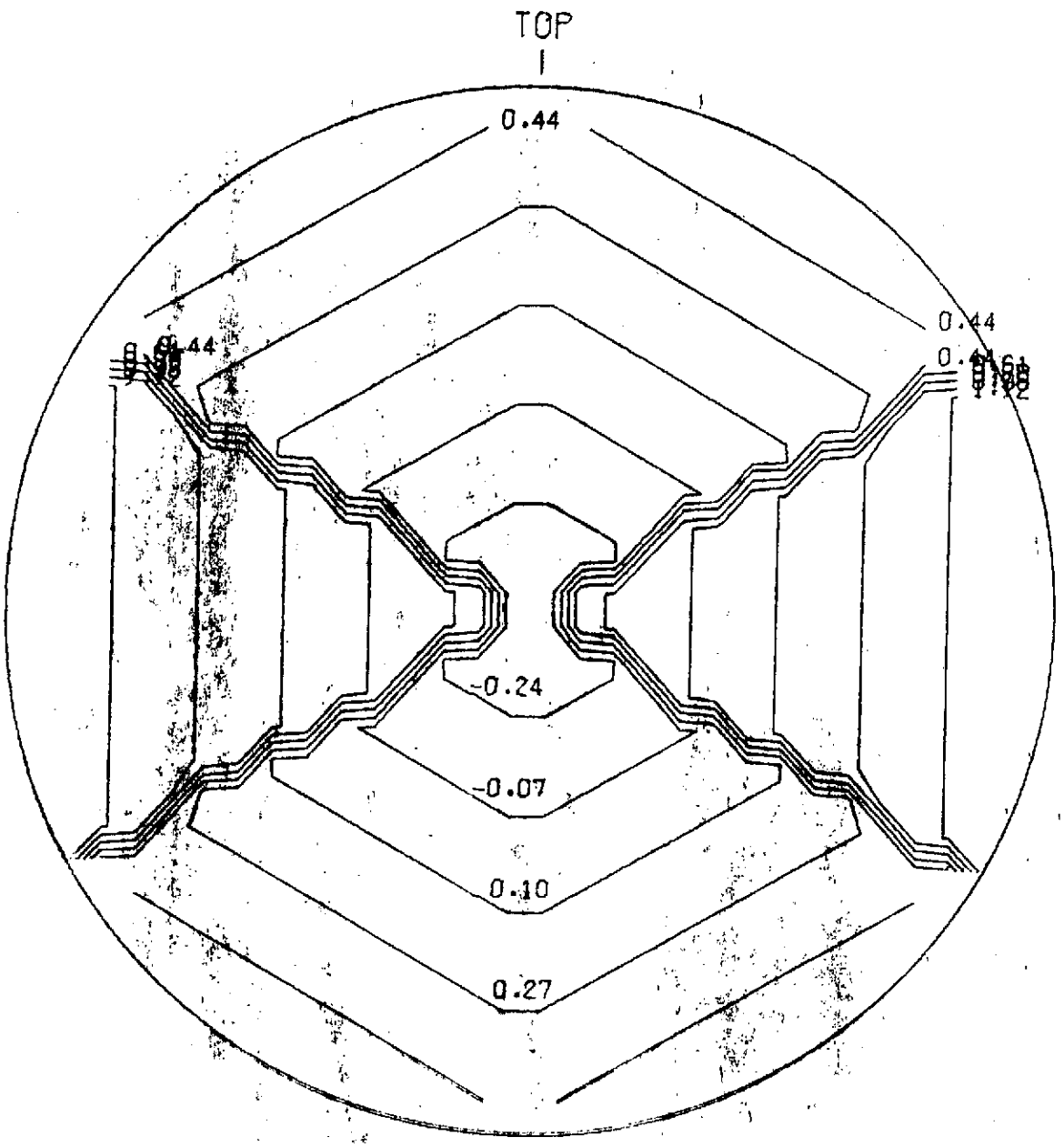

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FIGURE 15

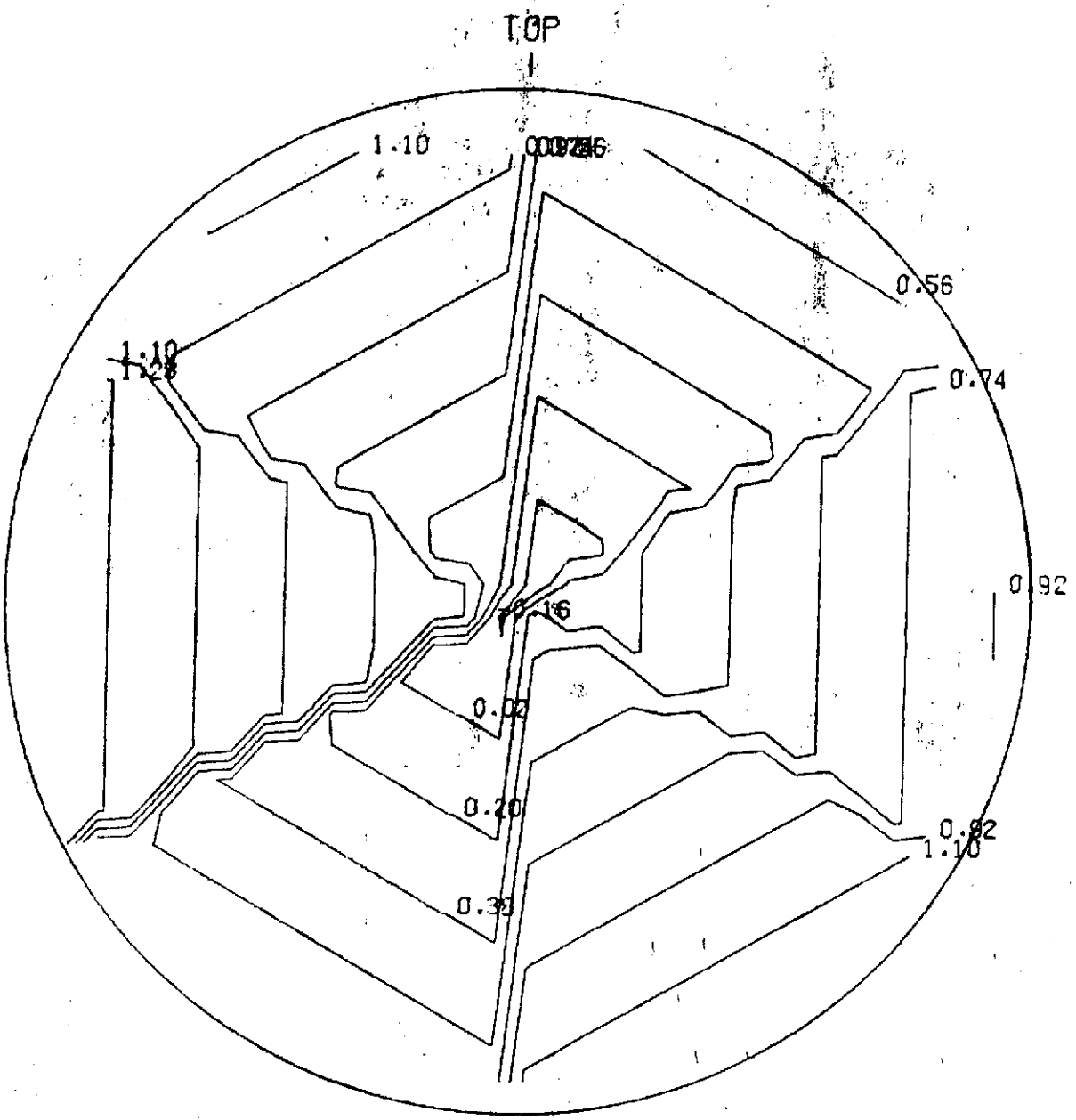
Task 2.1 – Nominal Cube-On Axis
Wavefront Map-P Polarisation

| | | |

FIGURE 16

Wavefront Plot-P Polarization

Task 2.1 - Nominal Cube-On Axis



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in the Itek developed FRED Program to obtain the resultant total intensity variation in the far field (Figures 17, 18, 19). In both the far field patterns and the wavefront patterns the tops of the patterns are observed looking from the cube corner toward the far field. The encircled energy was then obtained through the use of Itek's ENEN Program. The encircled energy is shown in Tables 3 and 4 in two microradian increments and five microradian increments respectively. The encircled energy is plotted out to 200 microradians in Figure 20. The effect of beveled edges are negligible as noted in Appendix A.

The full phase variation across the aperture for the Q and P polarizations respectively are shown in printer maps (Figures 21 and 23)** and wavefront plots (Figures 22 and 24) for the -15° off axis case. The resultant total intensity variation in the far field is shown in Figures 25, 26, and 27. The encircled energy distribution in the far field pattern is shown in Tables 5 and 6 and in Figure 28 for the -15° off axis case. The values shown in all of the -15° off axis cases' far field patterns must be multiplied by a 0.65 factor to obtain the intensity and encircled energy relative to the on axis case. This factor was obtained by computing the ratio of the areas exiting from the -15° off axis case and the on axis case. The ratio of the areas was obtained by ratioing the sum of the squares of the amplitudes of the P and Q polarization at -15° off axis to the sum of the squares of the amplitudes of the P and Q polarizations on axis.

** Table 7 provides a handy reference sheet for locating figures (plots) and tables which are grouped at the end of the text from this point on.

FIGURE-17

Task 2.1 - Nominal Cube-On Axis

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 μradians, Type
NORMALIZED SO LARGEST VALUE = 0.0265 = 100
TOTAL ENERGY = 0.2461000D+01
MAP REPRESENTS 0.2314043D+01 OR 94.0286 PERCENT OF TOTAL ENERGY

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Top, Typ.

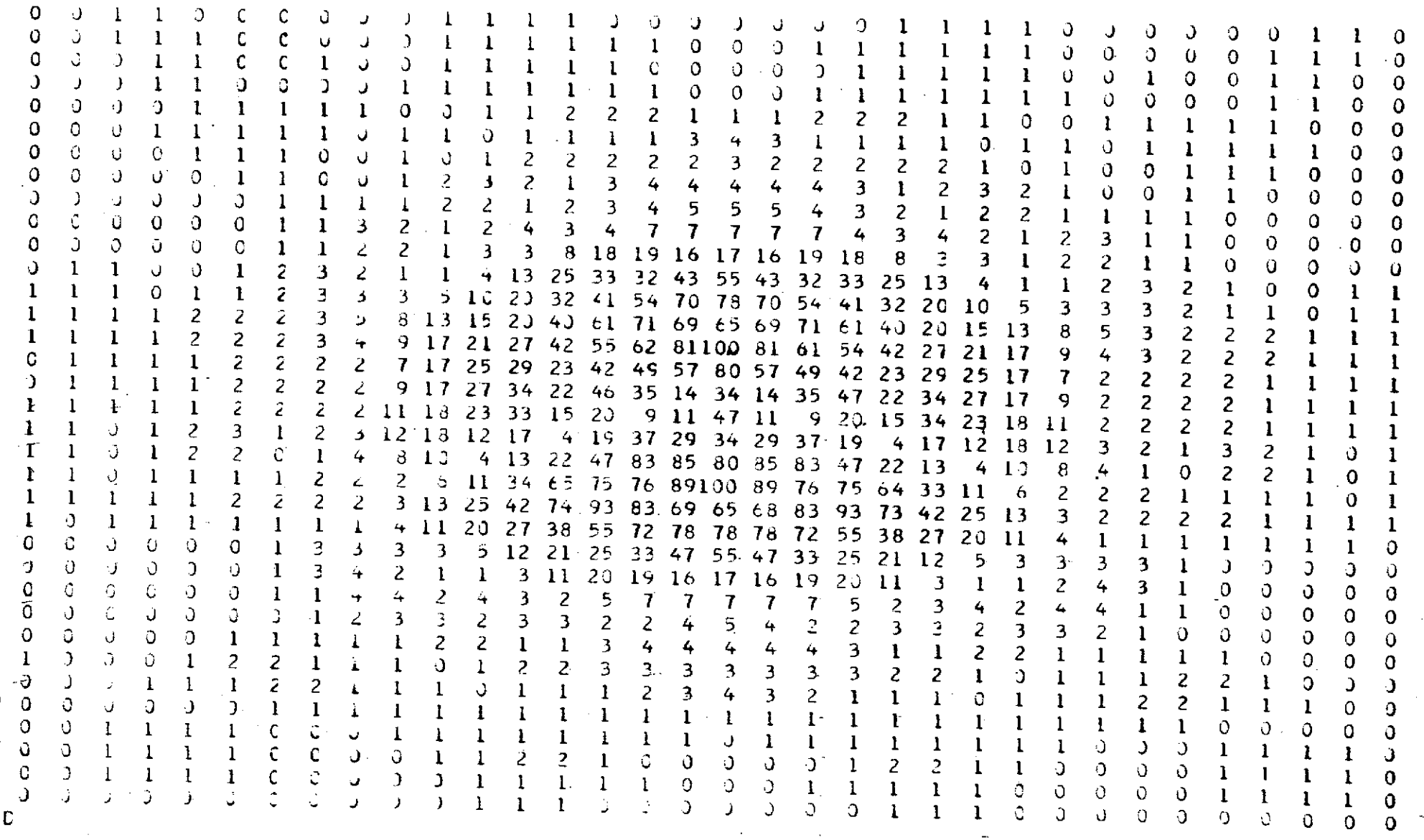

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FIGURE 18

Task 2.1 - Nominal Cube-On Axis

Intensity Distriubtion - Central 129 Microradians

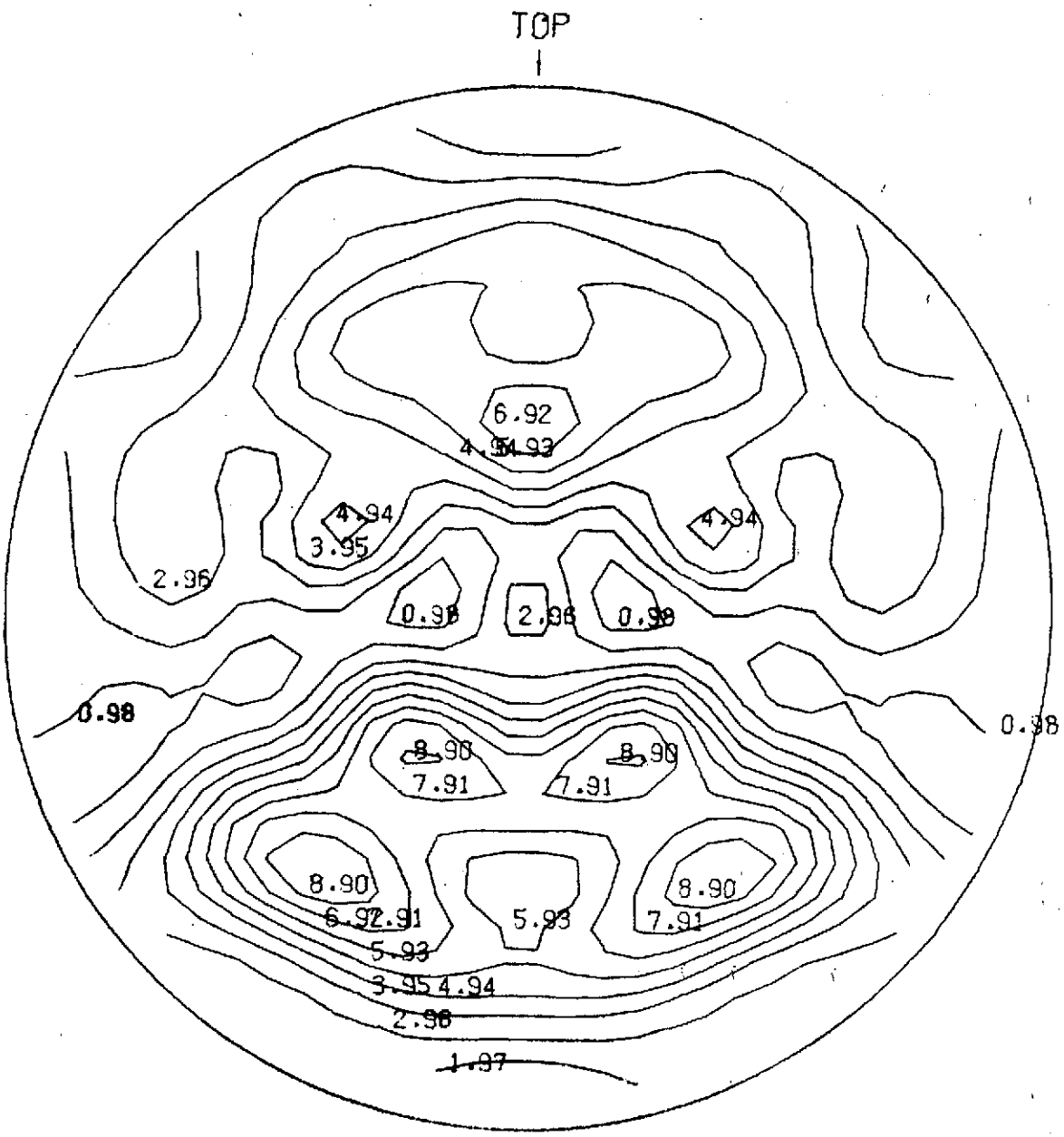
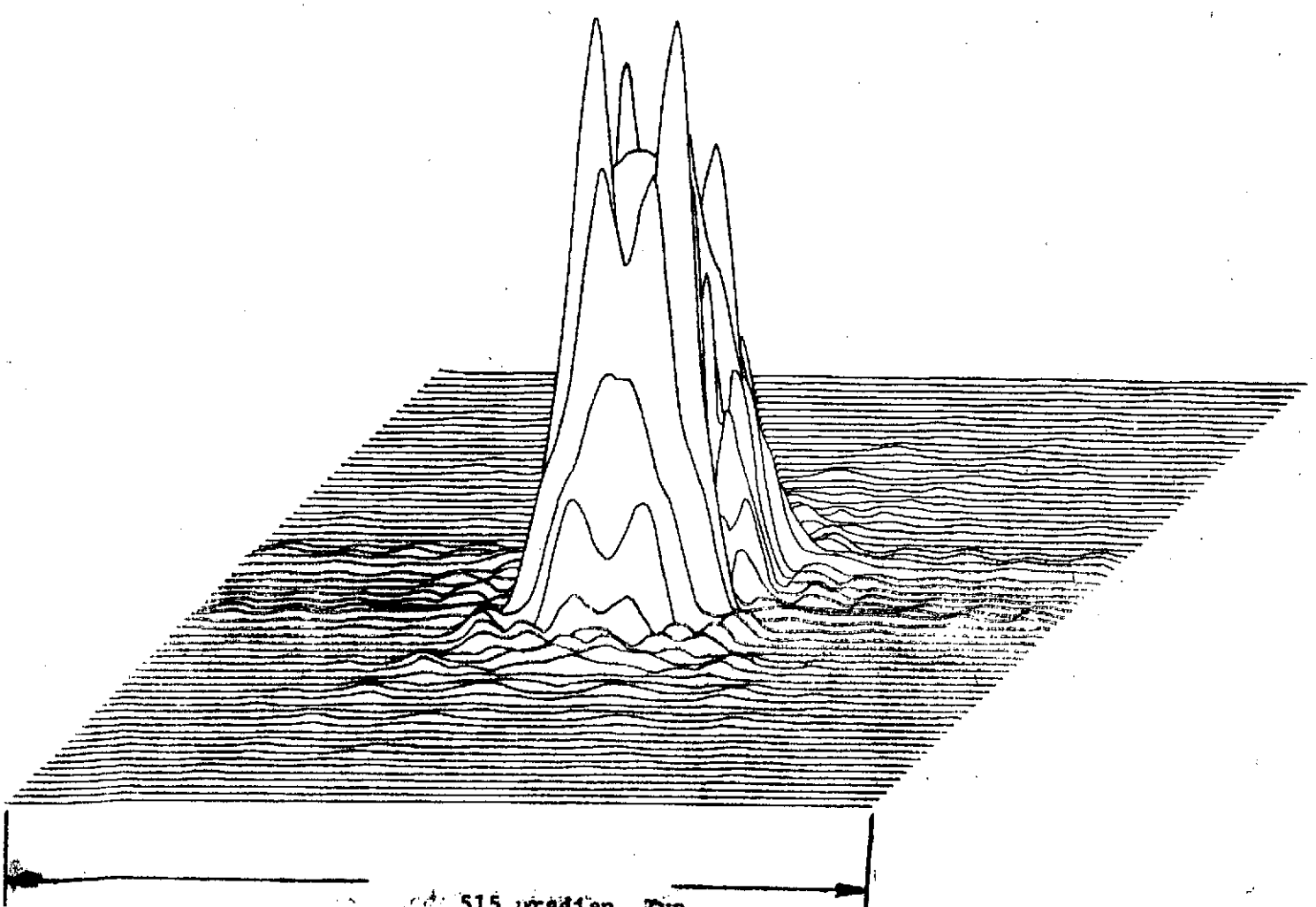


Figure 3-5

Point Spread Function

Task 2.1 - Nominal Cube-On Axis



Task 2.1 - Nominal Cube-On Axis

ENCIRCLED ENERGY

CIRCLE RADIUS Micro-Radians Typ.	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (Microradians) Typ.									
X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.0
4.00	0.3	0.3	0.2	0.0	0.1	0.0	0.2	0.5	0.5
6.00	0.3	0.3	0.8	0.2	0.8	0.2	0.9	0.5	0.5
8.00	1.0	1.0	1.4	0.5	0.8	0.5	1.6	1.5	1.5
10.00	1.4	1.4	2.0	0.8	1.5	0.8	2.3	2.1	2.1
12.00	3.4	3.4	3.1	1.6	1.7	1.6	3.7	4.2	4.2
14.00	3.4	3.4	4.2	3.1	2.6	3.1	5.3	4.2	4.2
16.00	5.9	5.9	5.6	4.1	3.4	4.1	6.9	6.8	6.8
18.00	7.0	7.0	6.9	5.9	6.6	5.9	8.5	8.0	8.0
20.00	9.2	9.2	9.1	7.6	6.6	7.6	10.8	10.3	10.3
22.00	10.2	10.2	11.1	10.3	11.1	10.3	12.7	11.5	11.5
24.00	13.1	13.1	13.1	11.6	13.2	11.6	14.6	14.6	14.5
26.00	14.5	14.5	15.7	15.0	17.8	15.0	17.0	16.2	16.2
28.00	18.2	18.2	19.7	18.6	19.0	18.6	21.3	20.0	20.0
30.00	20.7	20.7	22.1	22.0	23.5	22.0	23.5	22.9	22.9
32.00	25.9	25.9	26.0	24.9	25.8	24.9	27.6	28.0	28.0
34.00	27.0	27.0	29.0	29.6	29.1	29.6	31.0	29.2	29.2
36.00	32.5	32.5	33.1	32.9	33.2	32.8	35.6	34.5	34.5
38.00	35.1	35.1	36.2	37.0	38.4	37.0	38.7	37.3	37.3
40.00	39.4	39.4	40.0	40.6	41.1	40.5	43.0	41.7	41.7
42.00	41.7	41.7	43.8	45.7	47.4	45.6	46.6	44.0	44.0
44.00	46.2	46.2	46.8	47.9	50.9	47.9	49.8	48.4	48.4
46.00	49.2	49.2	50.6	53.3	56.8	53.3	53.3	51.5	51.5
48.00	53.1	53.1	54.9	57.0	58.4	57.0	57.3	55.2	55.2
50.00	56.3	56.3	57.7	60.3	63.3	60.3	59.5	58.4	58.4
52.00	60.1	60.1	61.6	63.7	65.5	63.7	63.1	61.7	61.7
54.00	62.2	62.2	64.7	66.9	68.8	66.9	65.6	63.8	63.8
56.00	66.1	66.1	68.6	70.0	70.9	70.0	69.1	67.0	67.0
58.00	68.8	68.8	70.6	71.9	73.7	71.9	71.0	69.4	69.4
60.00	71.3	71.2	73.3	74.2	75.7	74.2	73.5	71.6	71.6
62.00	73.1	73.1	75.2	75.9	77.7	75.9	75.3	73.3	73.4
64.00	75.6	75.6	76.7	77.2	79.2	77.2	77.0	75.7	75.7
66.00	77.0	77.0	78.5	78.8	80.7	78.8	78.8	77.1	77.1
68.00	78.7	78.7	79.9	79.9	81.4	79.9	80.0	78.9	78.9
70.00	79.7	79.7	81.1	80.9	82.3	80.9	81.1	79.8	79.8
72.00	81.1	81.1	82.0	81.8	82.9	81.8	82.0	81.2	81.2
74.00	81.8	81.8	83.0	82.7	83.5	82.7	82.9	81.9	81.9
76.00	82.9	82.9	83.7	83.4	83.8	83.4	83.6	82.9	82.9
78.00	83.6	83.6	84.1	84.0	84.3	84.0	84.0	83.6	83.6
80.00	84.3	84.3	84.6	84.5	84.6	84.5	84.6	84.3	84.3

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Task 2.1 - Nominal Cube-On Axis

ENCIRCLED ENERGY

CIRCLE RADIUS Micro-Radians Typ.	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (Microradians) Typ.								
	X= -10.13	-10.13	-10.13	0.0	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.3	0.3	0.6	0.2	0.5	0.2	0.7	0.5	0.5
10.00	1.4	1.4	2.0	0.8	1.5	0.8	2.3	2.1	2.1
15.00	4.9	4.9	5.2	3.5	3.4	3.5	6.4	5.7	5.7
20.00	9.2	9.2	9.1	7.6	6.6	7.6	10.8	10.3	10.3
25.00	14.0	14.0	14.9	14.7	15.1	14.7	16.4	15.7	15.6
30.00	20.7	20.7	22.1	22.0	23.5	22.0	23.5	22.9	22.9
35.00	30.3	30.3	31.1	30.5	32.1	30.5	33.1	32.3	32.3
40.00	39.4	39.4	40.0	40.6	41.1	40.5	43.0	41.7	41.7
45.00	47.9	47.9	48.9	51.5	54.3	51.5	51.7	50.1	50.1
50.00	56.3	56.3	57.7	60.3	63.3	60.3	59.5	58.4	58.4
55.00	64.8	64.8	66.9	68.5	70.4	68.5	67.7	65.8	65.8
60.00	71.3	71.2	73.3	74.2	75.7	74.2	73.5	71.6	71.6
65.00	76.3	76.2	77.9	78.2	80.2	78.2	78.1	76.4	76.4
70.00	79.7	79.7	81.1	80.9	82.3	80.9	81.1	79.8	79.8
75.00	82.5	82.5	83.3	83.1	83.6	83.1	83.3	82.5	82.5
80.00	84.3	84.3	84.6	84.5	84.6	84.5	84.6	84.3	84.3
85.00	85.5	85.5	85.6	85.8	85.8	85.8	85.7	85.6	85.6
90.00	86.5	86.5	86.6	86.8	86.8	86.8	86.8	86.7	86.7
95.00	87.5	87.5	87.6	87.7	87.9	87.7	87.8	87.7	87.7
100.00	88.4	88.4	88.5	88.6	88.9	88.6	88.6	88.5	88.5
105.00	89.2	89.2	89.4	89.4	89.6	89.4	89.4	89.2	89.2
110.00	89.9	89.9	90.1	90.0	90.2	90.0	90.0	89.9	89.9
115.00	90.5	90.5	90.6	90.5	90.6	90.5	90.6	90.6	90.6
120.00	91.0	91.0	91.0	91.1	91.1	91.1	91.1	91.1	91.1
125.00	91.4	91.4	91.5	91.5	91.5	91.5	91.6	91.5	91.5
130.00	91.9	91.9	91.9	92.0	92.1	92.0	92.0	92.0	92.0
135.00	92.4	92.4	92.4	92.4	92.5	92.4	92.4	92.3	92.3
140.00	92.8	92.8	92.8	92.8	92.8	92.8	92.9	92.8	92.8
145.00	93.1	93.1	93.1	93.2	93.2	93.2	93.2	93.1	93.1
150.00	93.4	93.4	93.4	93.5	93.5	93.5	93.5	93.4	93.4
155.00	93.8	93.8	93.8	93.8	93.8	93.8	93.7	93.8	93.8
160.00	94.2	94.2	94.1	94.1	94.1	94.1	94.0	94.1	94.1
165.00	94.4	94.4	94.5	94.4	94.4	94.4	94.4	94.4	94.4
170.00	94.7	94.7	94.8	94.7	94.8	94.7	94.8	94.7	94.7
175.00	95.0	95.0	95.0	95.0	95.1	95.0	95.1	95.0	95.0
180.00	95.2	95.2	95.3	95.3	95.4	95.3	95.3	95.3	95.3
184.99	95.5	95.5	95.5	95.6	95.5	95.6	95.5	95.6	95.6
189.99	95.7	95.7	95.7	95.8	95.8	95.8	95.7	95.8	95.8
194.99	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0
199.99	96.2	96.2	96.2	96.2	96.2	96.2	96.2	96.2	96.2

FIGURE 20

Encircled Energy

Vs

Field Angle

Task 2.1 - Nominal Cube-On Axis

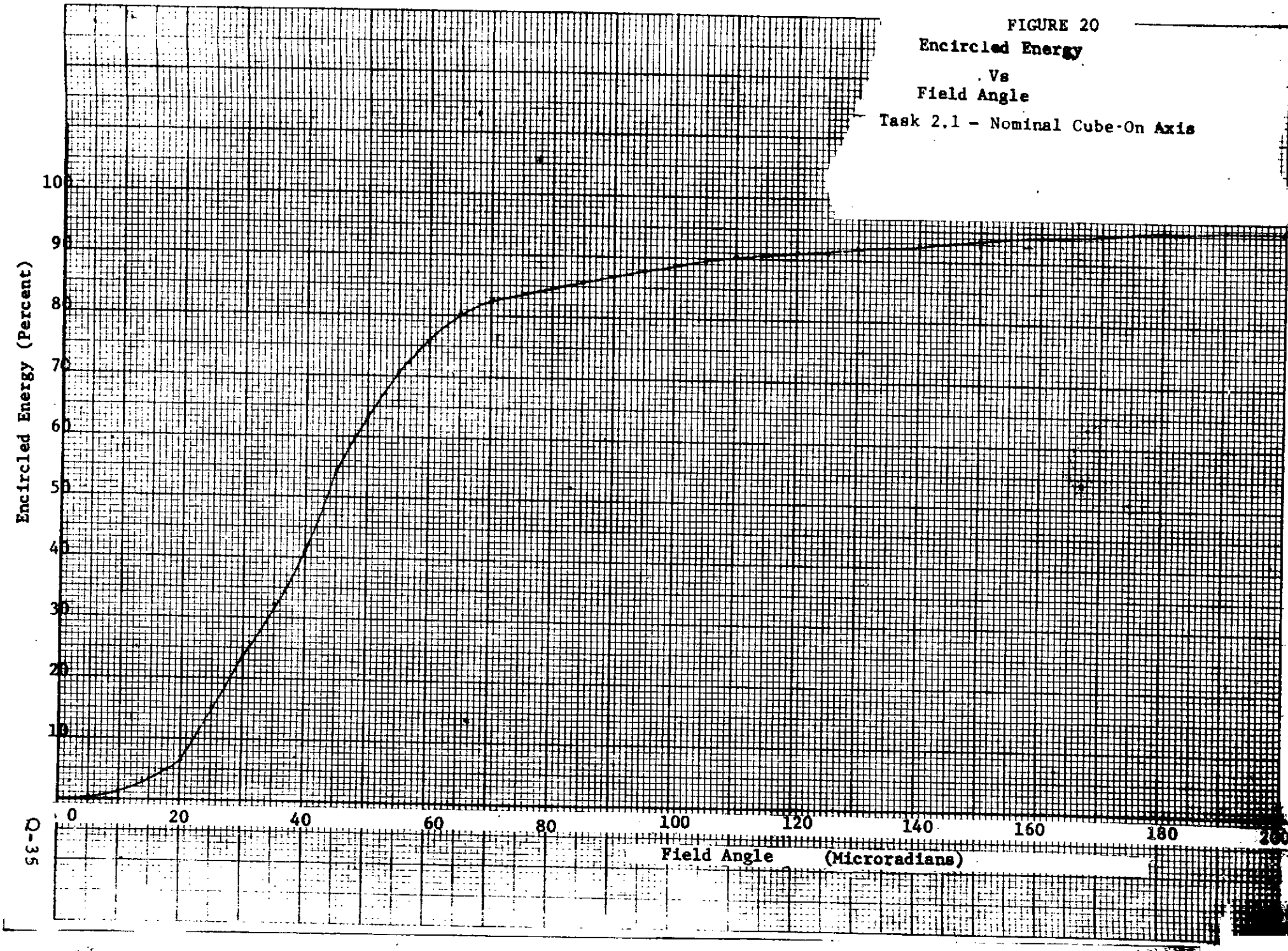

FIGURE 21

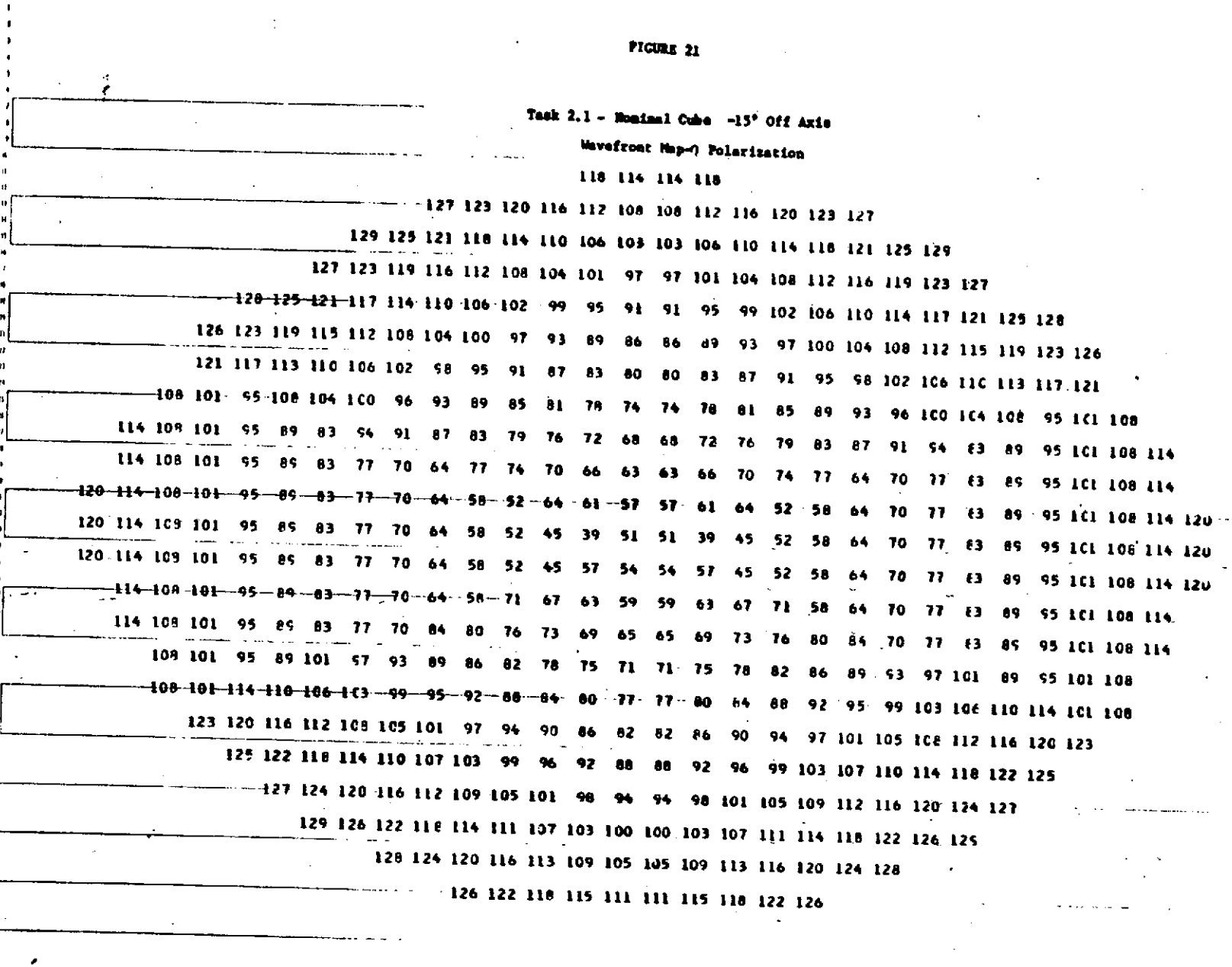
Task 2.1 - Nominal Cube -15° Off Axis
Wavefront Map-() Polarization
118 114 114 118
127 123 120 116 112 108 108 112 116 120 123 127
129 125 121 118 114 110 106 103 103 106 110 114 118 121 125 129
127 123 119 116 112 108 104 101 97 97 101 104 108 112 116 119 123 127
128 125 121 117 114 110 106 102 99 95 91 91 95 99 102 106 110 114 117 121 125 128
126 123 119 115 112 108 104 100 97 93 89 86 86 89 93 97 100 104 108 112 115 119 123 126
121 117 113 110 106 102 98 95 91 87 83 80 80 83 87 91 95 98 102 106 110 113 117 121
108 101 95 108 104 100 96 93 89 85 81 78 74 74 78 81 85 89 93 96 100 104 108 95 101 108
114 109 101 95 89 83 96 91 87 83 79 76 72 68 68 72 76 79 83 87 91 94 83 89 95 101 108 114
114 108 101 95 89 83 77 70 64 77 74 70 66 63 63 66 70 74 77 64 70 77 83 89 95 101 108 114
120 114 108 101 95 89 83 77 70 64 58 52 64 61 57 57 61 64 52 58 64 70 77 83 89 95 101 108 114
120 114 109 101 95 89 83 77 70 64 58 52 45 39 51 51 39 45 52 58 64 70 77 83 89 95 101 108 114 120
120 114 109 101 95 89 83 77 70 64 58 52 45 57 54 54 57 45 52 58 64 70 77 83 89 95 101 108 114 120
114 108 101 95 89 83 77 70 64 58 71 67 63 59 59 63 67 71 58 64 70 77 83 89 95 101 108 114 120
114 108 101 95 89 83 77 70 84 80 76 73 69 65 65 69 73 76 80 84 70 77 83 89 95 101 108 114
108 101 95 89 101 97 93 89 86 82 78 75 71 71 75 78 82 86 89 93 97 101 89 95 101 108
108 101 114 110 106 103 99 95 92 88 84 80 77 77 80 84 88 92 95 99 103 106 110 114 101 108
123 120 116 112 108 105 101 97 94 90 86 82 82 86 90 94 97 101 105 108 112 116 120 123
125 122 118 114 110 107 103 99 96 92 88 88 92 96 99 103 107 110 114 118 122 125
127 124 120 116 112 109 105 101 98 94 94 98 101 105 109 112 116 120 124 127
129 126 122 118 114 111 107 103 100 100 103 107 111 114 118 122 126 125
128 124 120 116 113 109 105 105 109 113 116 120 124 128
126 122 118 115 111 111 115 118 122 126

FIGURE 22

Task 2.1 - Nominal Cube -15° Off Axis

Wavefront Plot-Q Polarization

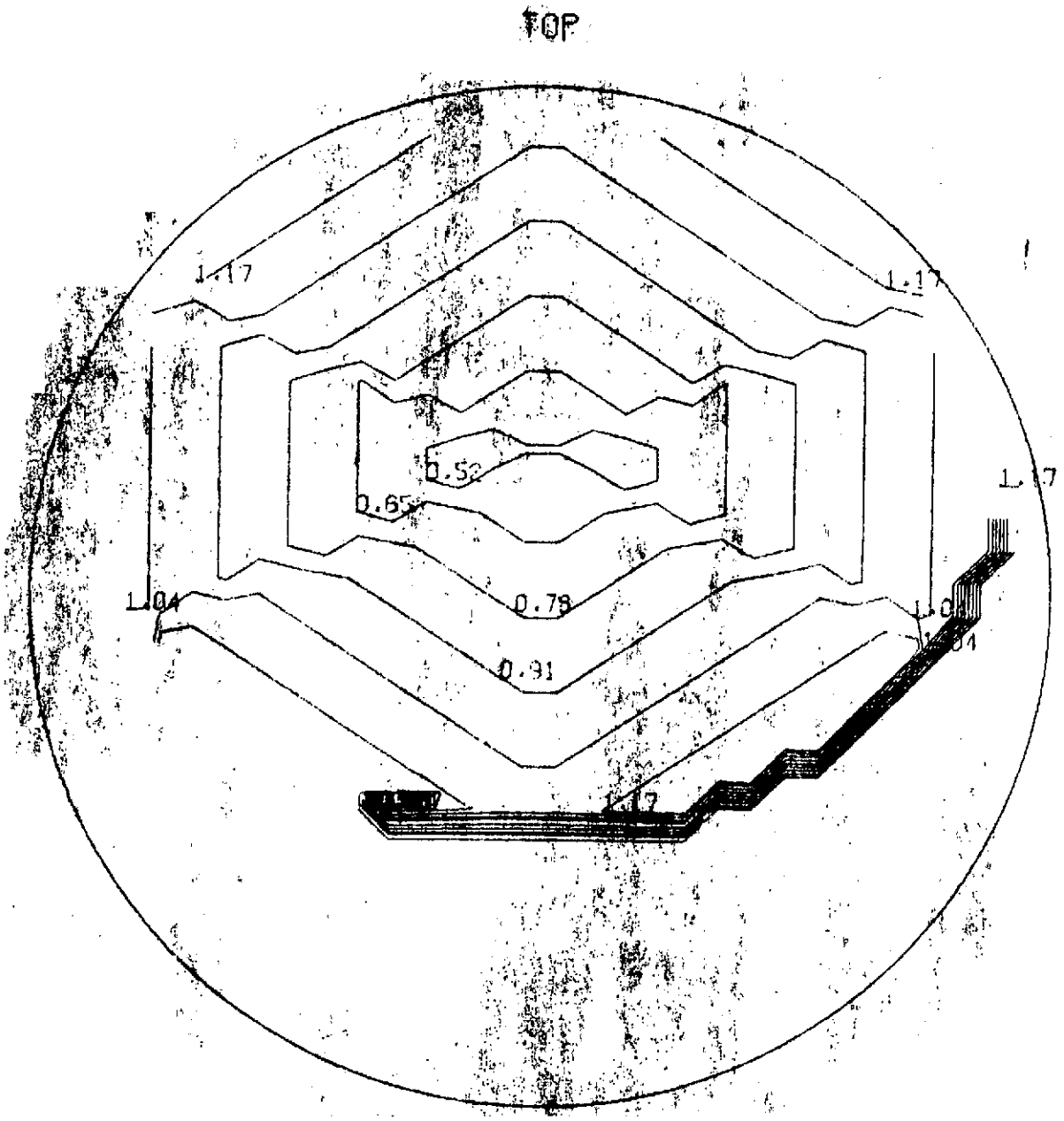

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FIGURE 23

Task 2.1 - Nominal Cube -15° Off Axis

Wavefront Map-P Polarization

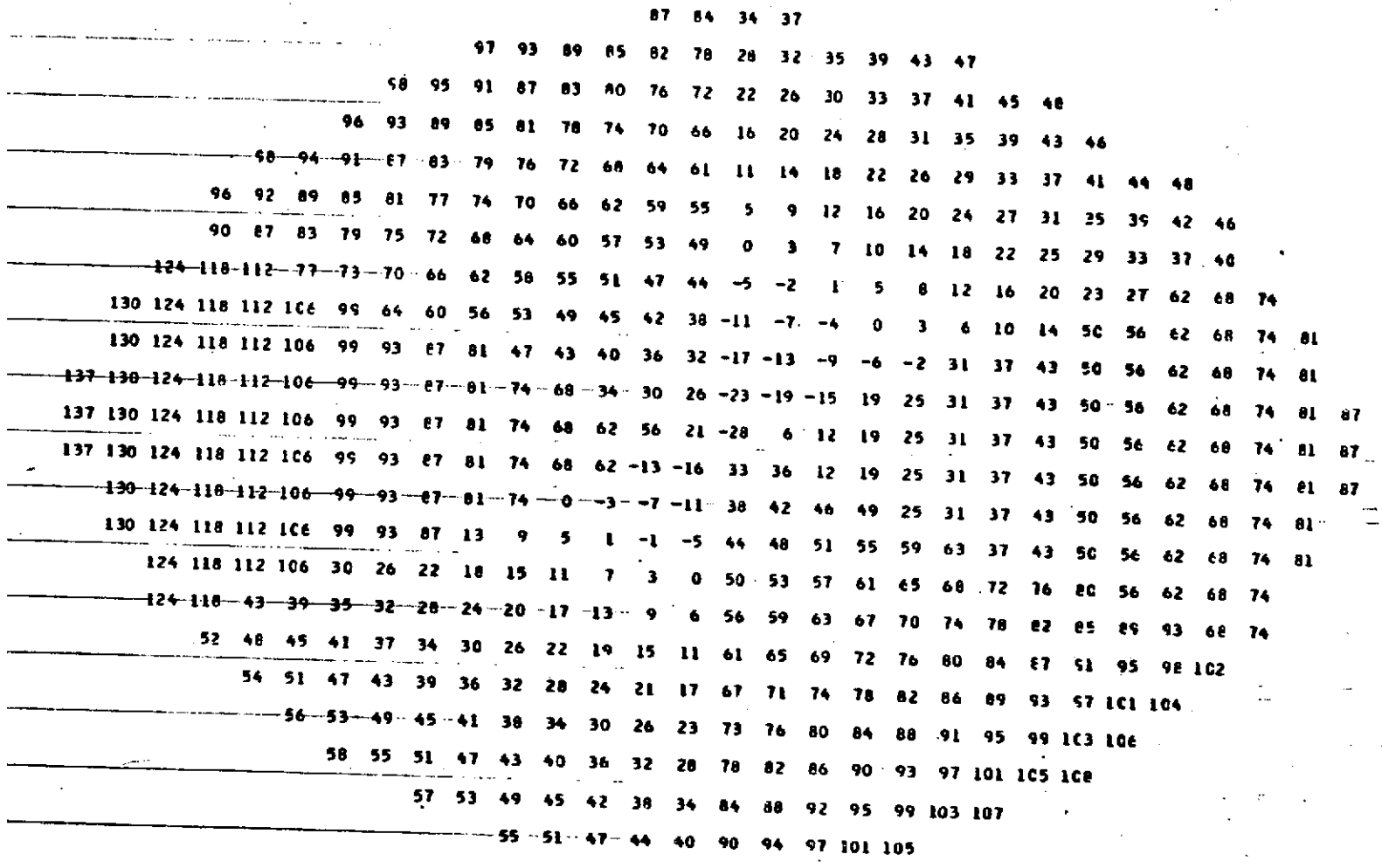

FIGURE 24

Task 2.1 - Nominal Cube -15° Off Axis
Wavefront Plot-P Polarization

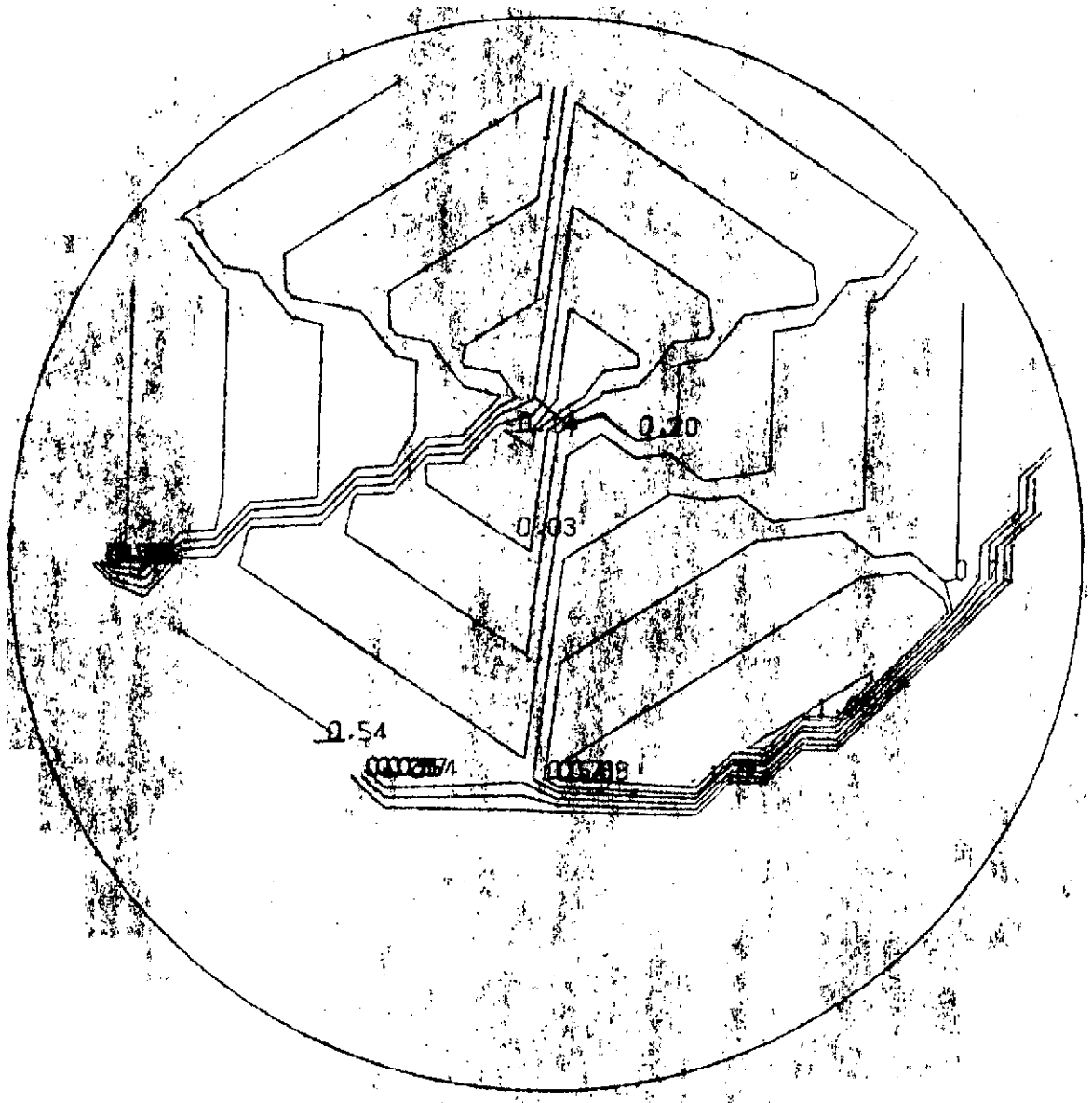

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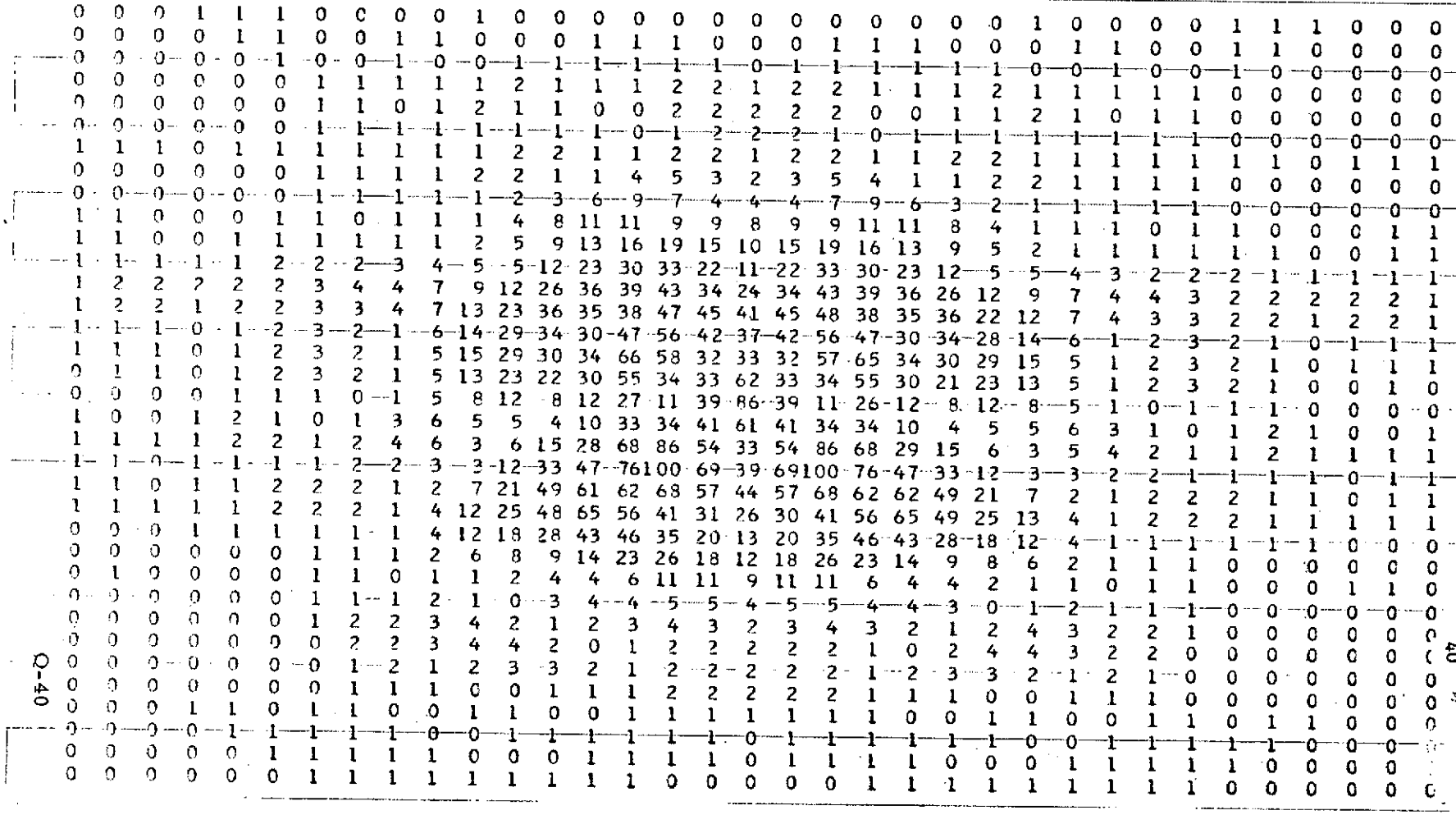
FIGURE 25

Task 2.1 - Nominal Cube -15° Off Axis

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0215 = 100
TOTAL ENERGY = 0.1870400D+01
MAP REPRESENTS 0.1742041D+01 OR 93.1373 PERCENT OF TOTAL ENERGY



Q-40

FIGURE 26

Task 2.1 - Nominal Cube -15° Off Axis
Point Spread Function

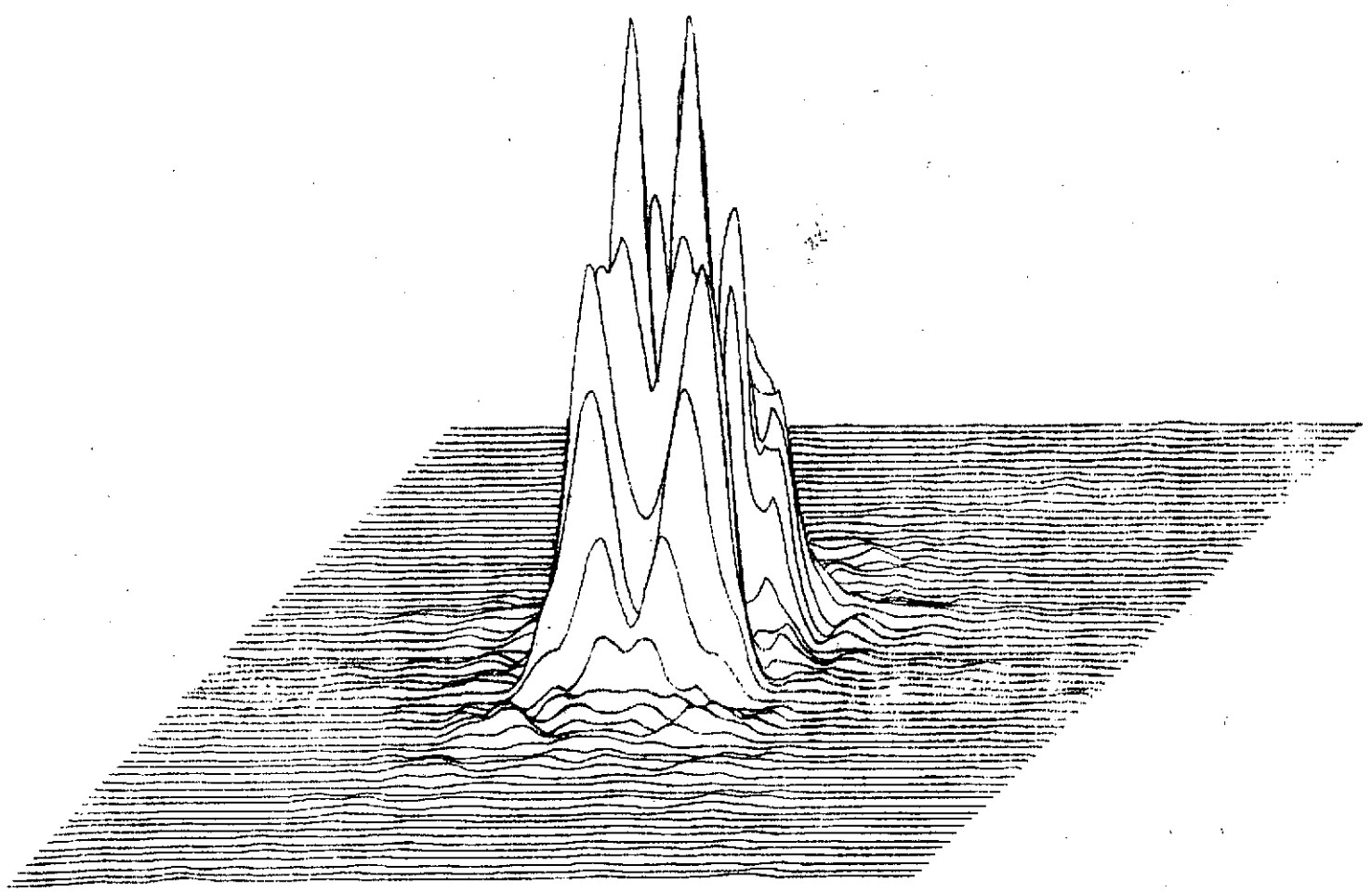
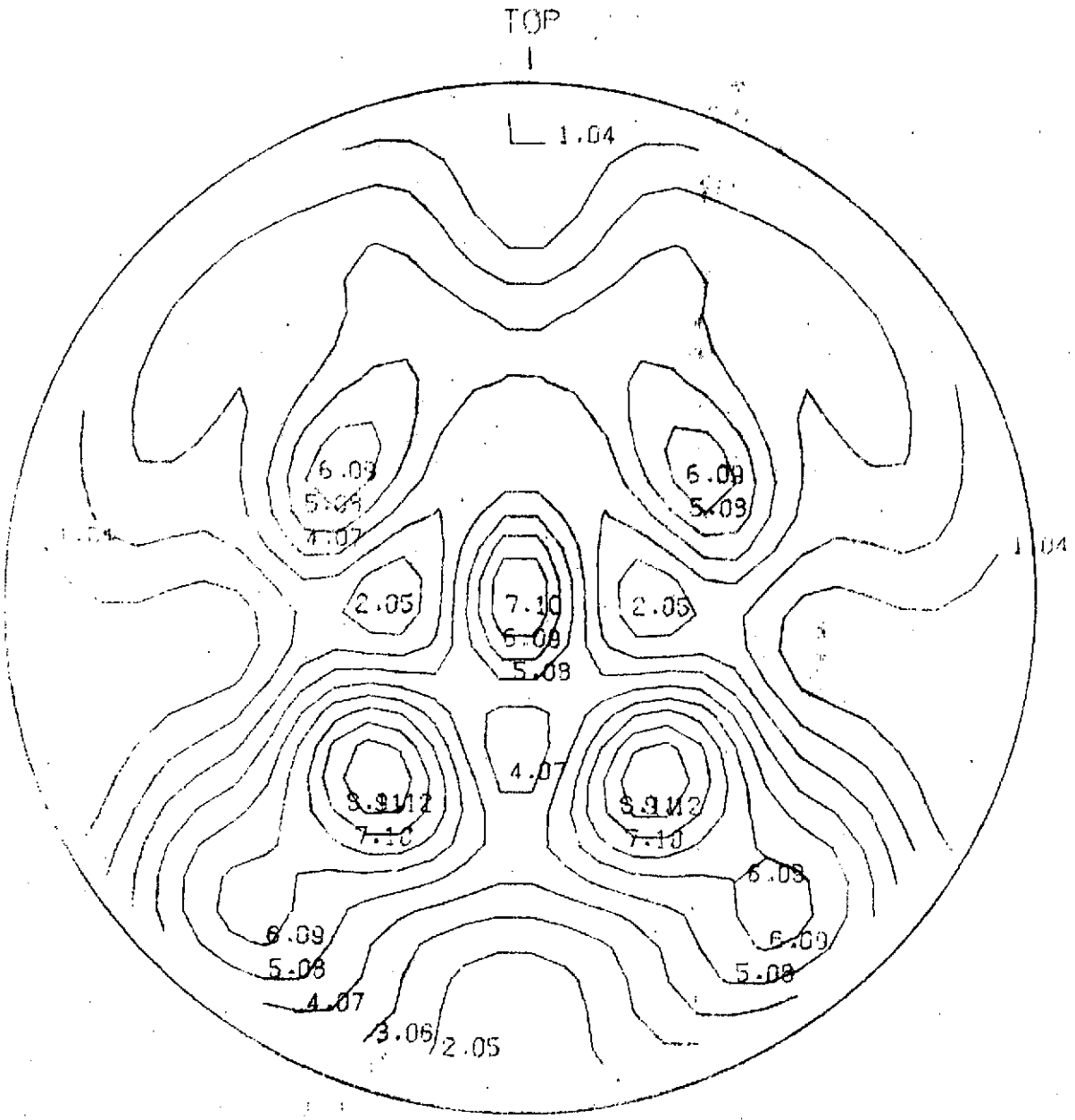


FIGURE 27

Task 2.1 - Nominal Cube -15° Off Axis

Intensity Distriubtion - Central 129 Microradians



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Task 2.1 - Nominal Cube -15° Off Axis

ENCIRCLED ENERGY

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.1	0.0	0.2	0.0	0.1	0.0	0.0
4.00	0.4	0.4	0.3	0.2	0.2	0.2	0.3	0.5	0.5
6.00	0.4	0.4	0.9	0.5	1.8	0.5	1.0	0.5	0.5
8.00	1.2	1.2	1.7	1.2	1.8	1.2	1.8	1.6	1.6
10.00	1.7	1.7	2.1	1.6	3.4	1.6	2.4	2.2	2.2
12.00	3.9	3.9	3.4	3.0	3.9	3.0	3.8	4.6	4.6
14.00	3.9	3.9	4.5	4.6	4.9	4.6	5.4	4.6	4.6
16.00	6.6	6.5	5.8	6.1	5.7	6.0	7.0	7.7	7.7
18.00	7.6	7.6	7.2	7.8	8.0	7.8	8.8	9.0	9.0
20.00	9.9	9.9	9.4	9.9	8.0	9.9	11.5	11.5	11.6
22.00	11.0	11.0	11.5	12.3	11.4	12.3	14.0	12.9	12.9
24.00	13.7	13.7	13.2	13.6	13.7	13.5	15.9	16.0	16.0
26.00	15.0	15.0	16.0	16.5	17.9	16.5	18.9	17.6	17.6
28.00	18.1	18.0	19.2	19.3	19.3	19.3	22.6	20.8	20.8
30.00	20.2	20.2	21.9	22.3	24.1	22.3	25.0	23.6	23.6
32.00	24.6	24.6	24.5	24.7	27.0	24.7	27.7	27.7	27.7
34.00	25.4	25.4	27.7	28.7	30.2	28.7	30.9	28.7	28.7
36.00	30.4	30.4	30.9	31.8	34.2	31.8	34.1	33.2	33.1
38.00	32.8	32.8	34.2	35.4	37.8	35.4	36.7	35.7	35.7
40.00	36.9	36.9	37.6	38.9	39.9	38.9	40.3	39.4	39.4
42.00	39.1	39.1	41.5	43.1	43.6	43.0	43.8	41.5	41.5
44.00	43.5	43.5	44.1	45.0	46.4	45.0	46.3	45.6	45.6
46.00	46.3	46.3	47.8	49.3	50.3	49.3	50.0	48.6	48.6
48.00	49.7	49.7	51.4	52.4	52.0	52.4	53.9	51.9	51.8
50.00	52.7	52.7	53.8	55.0	56.2	55.0	56.2	55.1	55.1
52.00	55.7	55.7	56.8	57.8	59.3	57.8	59.4	58.3	58.3
54.00	57.6	57.6	59.6	60.9	62.7	60.8	62.1	60.1	60.1
56.00	60.8	60.8	62.8	64.0	65.7	63.9	65.4	63.2	63.2
58.00	63.3	63.3	64.9	66.0	68.9	66.0	67.2	65.7	65.7
60.00	65.6	65.6	67.6	68.9	71.3	68.9	69.9	67.9	67.9
62.00	67.6	67.6	69.9	71.3	73.4	71.3	71.9	69.7	69.7
64.00	70.7	70.7	71.7	73.0	75.2	73.0	73.5	72.1	72.1
66.00	72.6	72.6	74.1	75.3	77.0	75.3	75.5	73.8	73.8
68.00	74.6	74.7	76.0	76.7	77.7	76.7	76.8	75.5	75.5
70.00	76.2	76.2	77.6	78.1	79.1	78.1	78.1	76.8	76.8
72.00	78.0	78.0	78.9	79.1	80.2	79.1	79.1	78.2	78.2
74.00	78.9	78.9	80.2	80.3	81.1	80.3	80.1	79.0	79.0
76.00	80.4	80.4	81.3	81.2	81.8	81.2	81.0	80.2	80.2
78.00	81.3	81.3	81.8	81.9	82.6	81.9	81.5	81.0	81.0
80.00	82.2	82.2	82.7	82.7	83.2	82.7	82.3	81.8	81.8

TABLE 6

Task 2.1 - Nominal Cube, -15° Off Axis

ENCIRCLED ENERGY

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS):									
X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.4	0.4	0.8	0.5	1.1	0.5	0.9	0.5	0.5
10.00	1.7	1.7	2.1	1.6	3.4	1.6	2.4	2.2	2.2
15.00	5.5	5.5	5.5	5.4	5.7	5.4	6.4	6.4	6.4
20.00	9.9	9.9	9.4	9.9	8.0	9.9	11.5	11.5	11.6
25.00	14.6	14.6	15.5	16.1	14.9	16.1	18.3	17.0	17.1
30.00	20.2	20.2	21.9	22.3	24.1	22.3	25.0	23.6	23.6
35.00	28.6	28.6	29.1	29.7	33.1	29.7	32.0	31.3	31.3
40.00	36.9	36.9	37.6	38.9	39.9	38.9	40.3	39.4	39.4
45.00	44.9	44.9	46.2	47.8	48.2	47.8	48.4	47.1	47.1
50.00	52.7	52.7	53.8	55.0	56.2	55.0	56.2	55.1	55.1
55.00	59.7	59.7	61.1	62.2	65.0	62.2	63.7	62.1	62.1
60.00	65.6	65.6	67.6	68.9	71.3	68.9	69.9	67.9	67.9
65.00	71.5	71.5	73.3	74.5	76.1	74.5	74.8	72.9	72.9
70.00	76.2	76.2	77.6	78.1	79.1	78.1	78.1	76.8	76.8
75.00	79.9	79.9	80.7	80.7	81.5	80.7	80.5	79.7	79.7
80.00	82.2	82.2	82.7	82.7	83.2	82.7	82.3	81.8	81.8
85.00	83.7	83.7	84.0	84.2	84.4	84.2	83.7	83.5	83.5
90.00	84.9	84.9	85.1	85.2	85.3	85.2	85.0	84.9	84.9
95.00	85.9	85.9	86.0	86.0	86.0	86.0	86.1	86.1	86.1
100.00	86.8	86.7	86.8	86.8	86.9	86.8	87.1	87.0	87.0
105.00	87.5	87.5	87.5	87.7	87.9	87.7	88.0	87.8	87.8
110.00	88.3	88.3	88.4	88.5	88.7	88.5	88.7	88.5	88.5
115.00	89.2	89.2	89.2	89.3	89.4	89.3	89.3	89.2	89.2
120.00	89.9	89.9	90.0	89.9	90.0	89.9	89.8	89.8	89.8
125.00	90.5	90.5	90.6	90.5	90.6	90.5	90.3	90.3	90.3
130.00	91.0	91.0	91.1	91.0	91.1	91.0	90.8	90.8	90.8
135.00	91.3	91.3	91.3	91.4	91.5	91.4	91.5	91.4	91.4
140.00	91.8	91.8	91.9	91.9	91.8	91.9	91.9	91.8	91.8
145.00	92.3	92.3	92.3	92.2	92.2	92.2	92.2	92.2	92.2
150.00	92.7	92.7	92.8	92.6	92.7	92.6	92.6	92.6	92.6
155.00	93.0	93.0	93.1	93.0	93.1	93.0	93.0	92.9	92.9
160.00	93.4	93.4	93.4	93.4	93.4	93.4	93.3	93.4	93.4
165.00	93.7	93.7	93.7	93.8	93.8	93.8	93.8	93.8	93.8
170.00	94.0	94.0	94.0	94.1	94.1	94.1	94.1	94.1	94.1
175.00	94.3	94.3	94.3	94.4	94.4	94.4	94.4	94.4	94.4
180.00	94.6	94.6	94.7	94.7	94.8	94.7	94.7	94.7	94.7
184.99	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0
189.99	95.3	95.3	95.3	95.3	95.3	95.3	95.2	95.2	95.2
194.99	95.5	95.5	95.6	95.5	95.6	95.5	95.4	95.4	95.4
199.99	95.8	95.8	95.8	95.8	95.8	95.8	95.7	95.7	95.7

FIGURE 28

Encircled Energy

Vs

Field Angle

Task 2.1 - Nominal Cube -15° Off Axis

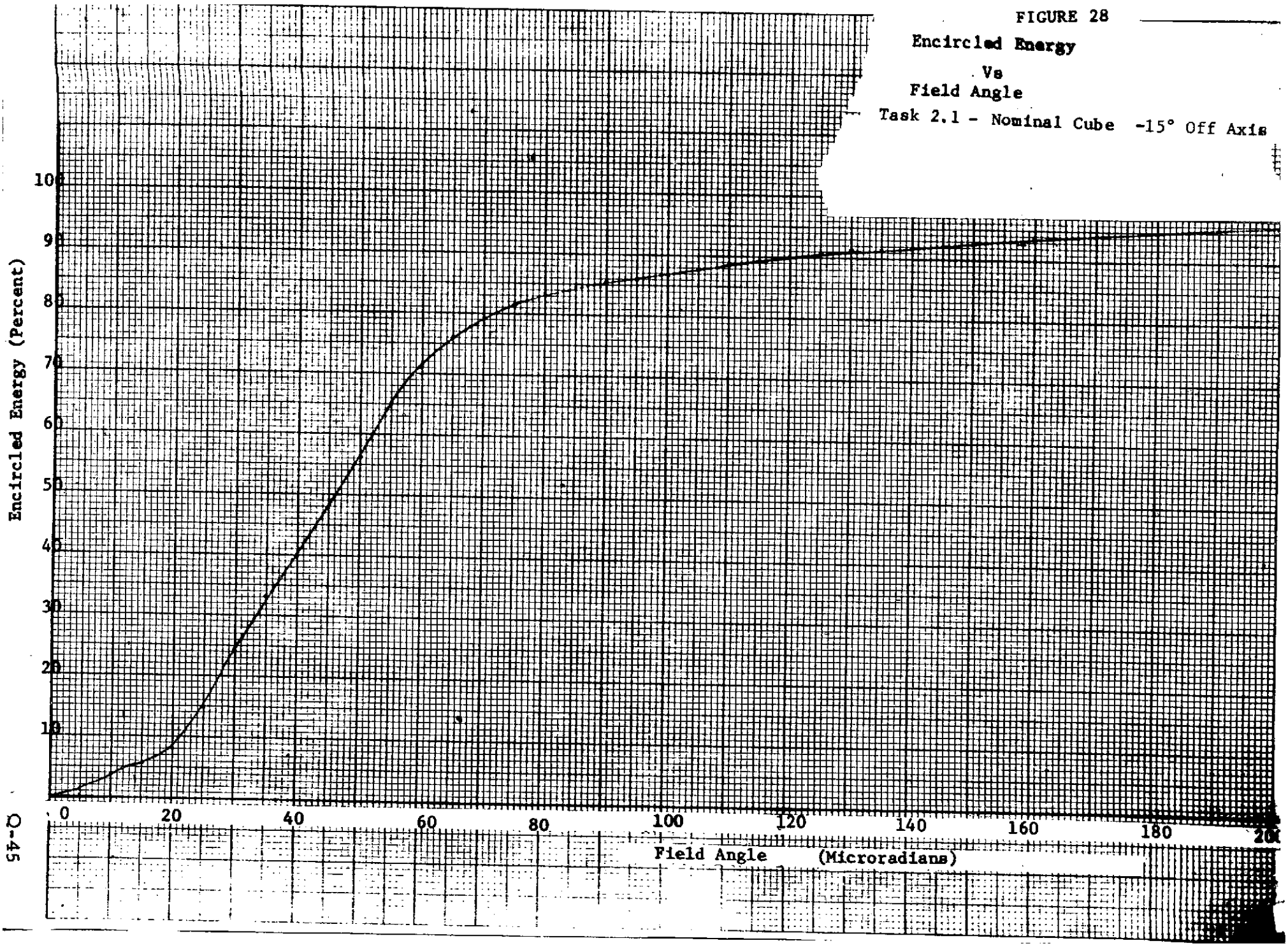

TABLE 7

Figure Numbers and Tables That Give the Performance of the Specified Cases

Task	Case	Wavefront Maps	Wavefront Plots	Intensity Map	Intensity Plot	Encircled Energy Plot	Encircled Energy Tables
2.1	Nominal Cube-On Axis	13,15	14,16	17	18,19	20	3,4
2.1	Nominal Cube-$\bar{}$15° Off Axis	21,23	22,24	25	26,27	28	5,6
2.2	Nominal Cube - On Axis + 0.278λ mfg error	29,31	30,32	33	34,35	36	8,9
2.2	Nominal Cube $\bar{}$15° Off Axis + 0.278λ mfg error	37,39	38,40	41	42,43	44	10,11
2.3B	Nominal Cube On Axis + 0.278λ mfg error + first temperature case	55,57	56,58	59	60,61	62	12,13
2.3B	Nominal Cube $\bar{}$15° Off Axis + 0.278λ mfg error + first temperature case	63,65	64,66	67	68,69	70	14,15
2.3A1	Nominal Cube On Axis * + 0.278λ mfg error + second temperature case	71,73	72,74	75	76,77	78	16,17
2.3A2	Nominal Cube On Axis + 0.278λ mfg error + third temperature case	79,81	80,82	83	84,85	86	18,19
2.5A	Nominal Cube On Axis + 0.278λ mfg error + axial gradient	87,89	88,90	91	92,93	94	20,21
2.5B	Nominal Cube On Axis + 0.278λ mfg error + radial gradient	95,97	96,98	99	100,101	102	22,23
2.4A	Off Nominal Cube On Axis + 0.278λ mfg error	103,105	104,106	107	108,109	110	24,25
2.4A	Off Nominal Cube $\bar{}$15° Off Axis + 0.278λ mfg error	111,113	112,114	115	116,117	118	26,27
2.4B2	Off Nominal Cube On Axis + 0.278λ mfg error + 1st ΔT case	119,121	120,122	123	124,125	126	28,29
2.4B2	Off Nominal Cube $\bar{}$15° Off Axis + 0.278λ mfg error + first temperature case	127,129	128,130	131	132,133	134	30,31

*Note: If figures are unlabelled an on axis condition is assumed.

ABSOLUTE INTENSITY

The results of the diffraction calculations performed in POINT are a square grid of points, each of which gives the energy diffracted into a square of a given size. A convenient measure is the ratio of the energy per steradian to the total energy emerging from the cube. This gives a number in units of steradians^{-1} which, when multiplied by the total power (or energy), gives the absolute intensity at that point. This number can be obtained from the computer printed maps of the point spread function as follows:

Figure 17 shows a map of a point spread function of the on axis nominal cube. Define the following items.

E = total energy in PSF
D = grid spacing (radians)
Im = largest value in PSF
Ip = printed value in map of PSF
I/E = ratio of intensity to total energy (steradians $^{-1}$)

The value of I/E is

$$I/E = \frac{Im}{100\ E\ D^2}\ Ip\ \text{Steradians}^{-1}$$

The values in Figure 17 are

E = 2.461
D = 8.04×10^{-6} radians
Im = 0.0265

So that

$$I/E = 1.67 \times 10^{6}\ Ip\ \text{Steradians}^{-1}$$

For example, the center point in Figure 17 has a value of 47. If the total power emerging from the cube were 1 watt, the intensity at the center would be

$$I = 7.83 \times 10^{7}\ \text{watts/steradian}$$

MANUFACTURING ERROR

A random wavefront with a correlation of 0.66 over the face was subsequently placed on each surface to simulate manufacturing errors on the small optical surfaces. The OPD on the surfaces were scaled so that the resultant wavefront OPD in each of the six output sectors would have 0.278λ OPD peak-peak* as measured at 0.6328 microns. The OPD's were determined by the equation (on axis);

$$\text{Surface Deformation} = \frac{0.278\ \lambda}{2\sqrt{3}\cos 55^{\circ}}$$

Since there is a variation in the angle at which the rays strike each surface, each of the six sectors output OPD was then scaled to 0.278λ peak to peak.

The resultant wavefront from the 0.278λ OPD condition was then added to the effects of polarization and the dihedral angle variation to obtain the manufacturing degraded wavefront. The performance of the manufacturing degraded cases are given in Figures 29-36 for the on axis case and Figures 37-44 for the -15° off axis case.

TEMPERATURE VARIATION EFFECT

Temperature distributions obtained from Bendix Aerospace were used to determine the effect of temperature variation on the performance of the cube corner. The first temperature case is shown in Figures 45 and 46. The temperature coefficient of the refractive index (DN/DT) of Homosil was found to be $8.98 \times 10^{-6}/^{\circ}C$ in going from a nominal temperature of 25°C to a final temperature at 2.8°C. This value was obtained by taking the average of DN/DT over that range as obtained from Amersil. The DN/DT of suprasil ranged from $7\text{-}8.5 \times 10^{-6}/^{\circ}C$ while the DN/DT of Homosil ranged from $8.32\text{-}9.0 \times 10^{-6}/^{\circ}C$. The value of DN/DT of Homosil was used as a worst case analysis. The DN/DT at 2.8°C was found to be $8.72 \times 10^{-6}/^{\circ}C$. The DN/DT at -46.95°C was $8.32 \times 10^{-6}/^{\circ}C$. The DN/DT used for the third temperature case (Figures 49 and 50), the radial gradient (Figure 51) and the axial gradient (Figure 52) was $9.0 \times 10^{-6}/^{\circ}C$. The effect of the specified axial gradient alone on the wavefront is shown in Figure 53. The effect of the radial gradient on the wavefront is shown in Figure 54. As may be seen from Figure 53 and 54 the radial and axial gradients work in opposite directions.

The specified axial gradient will compensate for the spread due to the non 90° dihedral angles while the radial gradient will add to the dihedral angle effect.

The temperature distributions given in Figures 45 to 50 were such that the axial gradient and the radial gradient compensated for each other. As a result the temperature distributions supplied had little effect on the performance of the corner cube as shown by the Figures listed in Table 7.

* 0.25λ pk-pk OPD over 90% of sector's area

TABLE 8

ENCIRCLED ENERGY

Task 2.2 - Nominal + Mfg. Error - On Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0
4.00	0.2	0.3	0.1	0.1	0.0	0.0	0.1	0.3	0.2
6.00	0.2	0.3	0.6	0.2	0.1	0.1	0.6	0.3	0.2
8.00	0.8	1.0	1.0	0.4	0.1	0.2	1.0	1.1	0.8
10.00	1.1	1.3	1.4	0.7	0.4	0.4	1.6	1.5	1.0
12.00	2.4	2.8	2.2	1.0	0.6	0.7	2.5	3.1	2.2
14.00	2.4	2.8	3.2	1.9	1.4	1.6	3.5	3.1	2.2
16.00	4.1	4.7	4.4	2.4	1.9	2.1	4.8	5.1	3.9
18.00	4.9	5.4	5.5	3.7	4.5	3.4	5.8	5.9	4.8
20.00	6.6	7.3	7.5	4.8	4.5	4.7	8.0	8.0	6.7
22.00	7.4	8.0	8.8	7.0	8.1	6.8	9.4	8.9	7.6
24.00	9.8	10.6	10.7	8.1	9.4	8.2	11.3	11.6	10.4
26.00	11.0	11.7	12.5	11.0	13.0	11.0	13.1	13.0	11.9
28.00	14.3	15.4	15.8	14.1	14.0	14.1	17.0	16.7	15.5
30.00	16.4	17.5	17.5	17.3	18.0	17.3	18.8	19.3	18.1
32.00	20.8	22.2	20.9	19.7	19.8	19.7	22.7	24.0	22.7
34.00	21.7	23.2	23.3	24.1	23.6	24.1	25.6	25.1	23.6
36.00	26.3	28.0	27.0	26.8	26.9	26.8	29.9	30.0	28.4
38.00	28.4	30.2	29.9	30.8	32.2	30.8	32.7	32.5	30.8
40.00	32.6	34.2	33.6	33.9	34.6	33.9	36.8	36.5	35.0
42.00	34.4	36.1	37.3	38.8	41.0	38.9	40.1	38.5	36.9
44.00	39.0	40.3	40.7	41.3	43.8	41.1	43.4	42.6	41.4
46.00	41.9	42.9	44.2	46.6	49.6	46.4	46.6	45.2	44.3
48.00	46.3	48.8	48.7	50.4	51.0	50.0	50.6	49.0	48.4
50.00	49.6	49.8	51.2	53.6	55.9	53.4	52.7	51.9	51.5
52.00	53.9	53.5	55.3	57.0	58.2	56.7	56.4	55.2	55.3
54.00	56.2	55.7	57.9	60.1	61.8	60.0	58.8	57.3	57.3
56.00	60.2	59.4	62.0	63.2	64.0	63.1	62.4	60.4	60.8
58.00	62.8	62.1	64.0	65.2	67.2	65.1	64.4	62.8	63.2
60.00	65.5	64.6	66.9	67.6	69.3	67.6	67.2	65.1	65.8
62.00	67.4	66.5	68.9	69.8	71.6	69.8	69.2	66.8	67.5
64.00	70.2	69.2	70.8	71.3	73.2	71.3	71.0	69.3	70.3
66.00	71.7	71.9	72.7	73.4	75.0	73.3	72.9	70.9	71.8
68.00	73.9	72.9	74.3	74.7	75.8	74.7	74.3	72.9	73.9
70.00	75.0	74.1	75.7	76.1	77.1	76.1	75.7	74.1	75.1
72.00	76.8	75.9	76.9	77.2	78.0	77.2	76.9	75.8	76.8
74.00	77.7	76.7	78.2	78.3	78.9	78.3	78.1	76.7	77.7
76.00	79.1	78.2	79.2	79.3	79.6	79.3	79.2	78.2	79.1
78.00	80.0	79.1	79.9	80.0	80.4	80.0	79.9	79.2	79.9
80.00	81.0	80.1	80.8	80.8	81.0	80.8	80.8	80.2	80.9

TABLE 9

ENCIRCLED ENERGY

Task 2.2 – Nominal + Mfg. Error On Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.2	0.3	0.4	0.2	0.1	0.1	0.4	0.3	0.2
10.00	1.1	1.3	1.4	0.7	0.4	0.4	1.6	1.5	1.0
15.00	3.4	3.9	4.0	2.1	1.9	1.8	4.3	4.3	3.2
20.00	6.6	7.3	7.5	4.8	4.5	4.7	8.0	8.0	6.7
25.00	10.6	11.4	11.9	10.8	11.2	10.7	12.5	12.6	11.4
30.00	16.4	17.5	17.5	17.3	18.0	17.3	18.8	19.3	18.1
35.00	24.5	26.1	25.3	24.7	26.0	24.7	27.7	27.9	26.5
40.00	32.6	34.2	33.6	33.9	34.6	33.9	36.8	36.5	35.0
45.00	40.7	41.9	42.5	44.8	47.4	44.7	45.2	44.2	43.0
50.00	49.6	49.8	51.2	53.6	55.9	53.4	52.7	51.9	51.5
55.00	58.8	58.0	60.4	61.7	63.5	61.5	61.0	59.1	59.6
60.00	65.5	64.6	66.9	67.6	69.3	67.6	67.2	65.1	65.8
65.00	70.9	69.9	72.0	72.6	74.3	72.6	72.2	70.1	71.0
70.00	75.0	74.1	75.7	76.1	77.1	76.1	75.7	74.1	75.1
75.00	78.5	77.6	78.7	78.8	79.2	78.9	78.7	77.6	78.5
80.00	81.0	80.1	80.8	80.8	81.0	80.8	80.8	80.2	80.9
85.00	82.6	82.0	82.6	82.8	82.9	82.8	82.8	82.2	82.7
90.00	84.1	83.9	84.3	84.5	84.6	84.5	84.5	84.1	84.4
95.00	85.6	85.8	85.8	86.0	86.3	86.0	86.0	85.8	85.8
100.00	86.8	87.2	87.2	87.3	87.8	87.4	87.3	87.1	86.9
105.00	87.9	88.3	88.5	88.4	88.8	88.5	88.5	88.2	88.0
110.00	89.0	89.3	89.4	89.3	89.6	89.4	89.3	89.2	89.0
115.00	89.9	90.1	90.1	90.1	90.2	90.0	90.1	90.1	89.9
120.00	90.6	90.7	90.7	90.7	90.7	90.7	90.8	90.8	90.7
125.00	91.2	91.2	91.2	91.3	91.3	91.3	91.4	91.3	91.3
130.00	91.7	91.7	91.8	91.8	91.9	91.9	91.9	91.8	91.8
135.00	92.2	92.3	92.3	92.3	92.5	92.3	92.3	92.3	92.2
140.00	92.7	92.7	92.8	92.8	92.9	92.8	92.8	92.7	92.7
145.00	93.0	93.1	93.1	93.2	93.2	93.2	93.2	93.1	93.1
150.00	93.4	93.4	93.5	93.5	93.5	93.5	93.5	93.5	93.4
155.00	93.8	93.8	93.8	93.8	93.8	93.8	93.8	93.8	93.8
160.00	94.2	94.2	94.1	94.1	94.1	94.1	94.0	94.1	94.1
165.00	94.5	94.4	94.5	94.4	94.4	94.4	94.4	94.4	94.4
170.00	94.7	94.7	94.8	94.7	94.8	94.7	94.8	94.7	94.7
175.00	95.0	95.0	95.0	95.0	95.1	95.0	95.1	95.0	95.0
180.00	95.2	95.2	95.3	95.3	95.4	95.3	95.3	95.3	95.3
184.99	95.5	95.5	95.5	95.6	95.5	95.6	95.5	95.6	95.6
189.99	95.7	95.8	95.7	95.8	95.8	95.8	95.8	95.8	95.8
194.99	96.0	96.0	96.0	96.0	96.1	96.0	96.0	96.0	96.0
199.99	96.2	96.3	96.2	96.2	96.2	96.2	96.2	96.2	96.3

FIGURE 29

Wavefront Map -Q Polarization

Task 2.2 - Nominal + Mfg. Error - On Axis

MAP IN UNITS OF 0.01 WAVES

```
                                                    58  53  48  44  40  53  55  55  56  58
                                        72  69  58  51  46  41  37  33  50  52  52  52  55  62  70  78
                                    71  64  57  50  45  40  37  33  28  43  46  47  47  51  57  65  71  76
                                60  62  55  48  42  38  35  32  29  25  33  37  39  41  45  51  57  61  65  67
                            62  59  53  46  39  34  31  30  28  26  22  22  27  31  34  38  44  48  51  53  55  97
                        54  53  49  43  36  30  25  24  24  24  22  18  13  18  23  28  33  38  41  43  44  45  48  52
                    45  44  43  40  33  25  20  18  18  20  20  18  14   5  11  17  23  29  33  36  36  37  38  41  45  50
                100  38  37  35  30  23  16  12  10  13  15  16  14  10   0   5  11  18  24  28  30  30  31  32  35  39  45 129
                105 100  96  28  22  14   7   3   4   7  11  12   9   4  -4   0   5  11  16  20  22  24  25  27  29 108 117 123
                107 101  56  91  16   7   0  -3  -2   2   6   6   3  -1  -8  -5  -1   2   5   9  13  16  19  21  97 107 116 123
            116 109 102  95  88  82  77  -5  -9  -8  -4   0   0  -2  -8 -13 -11 -10  -8  -5  -1   3   8  78  87  96 107 116 124 129
            119 111 102  94  86  80  75  70  64 -15 -12  -9  -8 -10 -15 -19 -18 -18 -18 -15 -11  66  72  79  87  96 106 116 125 131
            123 114 103  92  83  78  74  71  66  61  58 -18 -17 -18 -21 -25 -25 -26 -26  62  66  71  75  81  87  94 103 114 125 133
            127 117 105  93  83  78  75  73  69  64  61  60 -25 -25 -27 -32 -32 -33  59  65  70  74  78  82  86  92 100 112 123 134
            131 120 107  95  86  80  78  75  72  68  64  61  56  49 -32 -41  43  53  60  66  70  74  78  81  84  89  98 110 122 133
            133 122 110  58  89  84  81  78  74  70  66  60  53  43 -41 -32  49  56  61  64  68  72  75  78  80  86  95 107 120 131
            134 123 112 100  92  86  82  78  74  70  65  59 -33 -32 -32 -27 -25 -25  60  61  64  69  73  75  78  83  93 105 117 127
            133 125 114 103  54  87  81  75  71  66  62 -26 -26 -25 -25 -21 -18 -17 -18  58  61  66  71  74  78  83  92 103 114 123
            131 125 116 106  96  87  79  72  66 -11 -15 -18 -18 -18 -19 -15 -10  -8  -9 -12 -15  64  70  75  80  86  94 102 111 119
            129 124 116 107  96  87  78   8   3  -1  -5  -8 -10 -11 -13  -8  -2   0   0  -4  -8  -9  -5  77  82  88  95 102 109 116
        123 116 107  97  21  19  16  13   9   5   2  -1  -5  -8  -1   3   6   6   2  -2  -3   0   7  16  91  96 101 107
        123 117 108  29  27  25  24  22  20  16  11   5   3  -4   4   9  12  11   7   4   3   7  14  22  28  96 100 105
        125  45  39  35  32  31  30  30  28  24  18  11   5   0  10  14  16  15  13  10  11  16  23  30  35  37  38 106
            50  45  41  38  37  36  36  33  29  23  17  11   5  14  18  20  20  18  18  20  25  33  40  43  44  45
                52  48  45  44  43  41  38  33  28  23  18  13  18  22  24  24  24  25  30  36  43  49  53  54
                    57  55  53  51  48  44  38  34  31  27  22  22  26  28  30  31  34  39  46  53  59  62
                        67  65  61  52  51  45  41  39  37  33  25  29  32  35  38  42  48  55  62  68
                            76  71  65  57  51  47  47  46  43  28  33  37  40  45  50  57  64  71
                                78  70  62  55  52  52  52  50  33  37  41  46  51  58  65  72
                                                    58  56  55  55  53  40  44  48  53  58
```

FIGURE 30

Wavefront Plot-Q Polarization

Task 2.2 - Nominal + Mfg. Error - On Axis

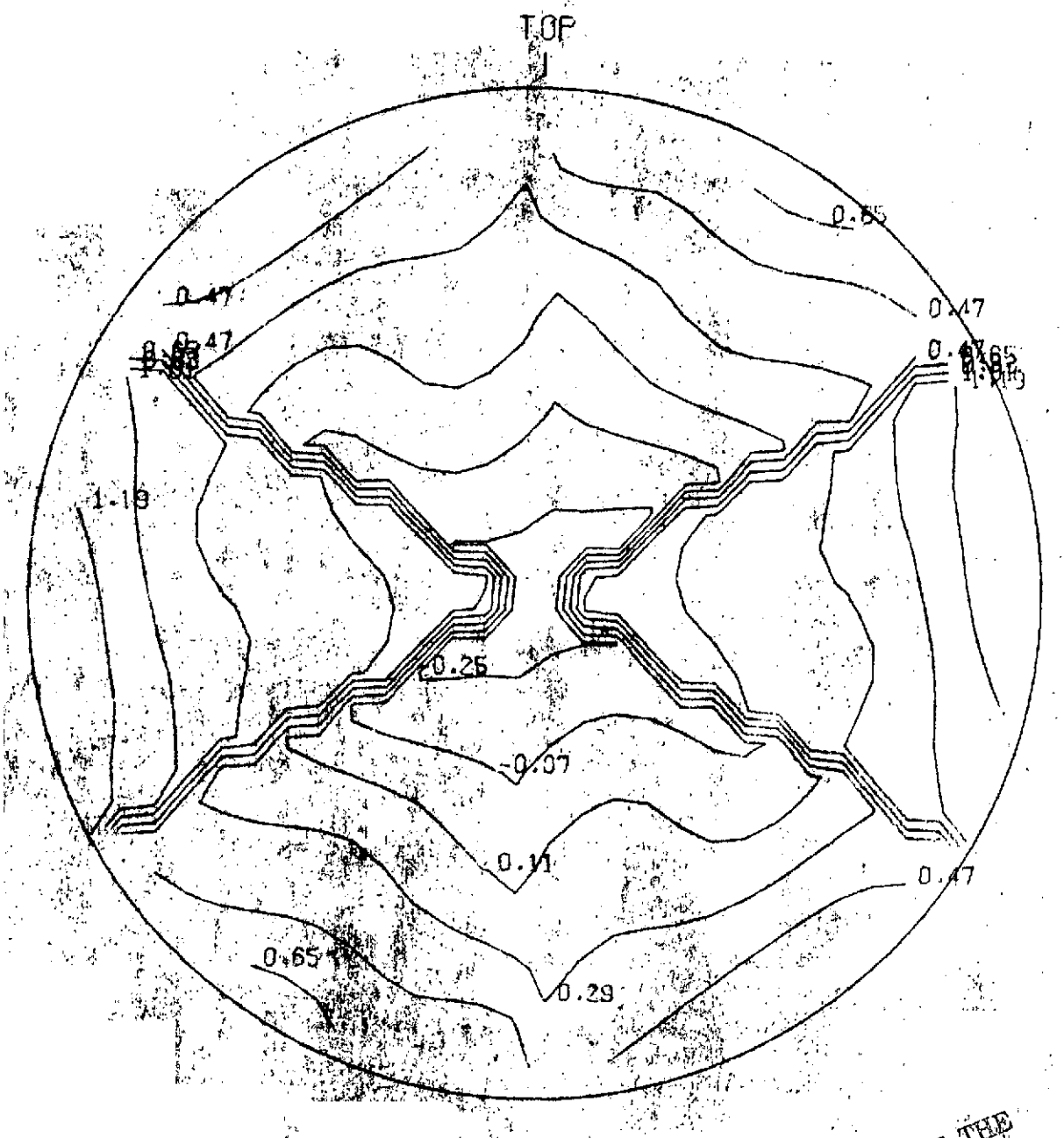

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FIGURE 31

Wavefront Map? Polarization

Task 2.2 - Nominal + Mfg. Error - On Axis

MAP IN UNITS OF 0.01 WAVES

										117	111	106	103	99	62	64	64	64	67												
							131	125	116	110	104	100	96	92	58	61	61	61	64	70	78	87									
						129	122	115	109	103	99	95	91	87	51	54	55	56	59	66	73	80	85								
					126	121	114	107	101	56	93	91	88	83	41	45	47	49	54	59	65	70	73	75							
				121	117	111	105	98	92	89	88	87	84	80	30	36	39	43	47	52	57	60	61	63	65						
			112	111	108	102	94	88	84	83	83	83	81	77	21	27	32	37	41	46	50	51	52	54	56	60				
		103	103	102	98	91	84	78	76	76	78	79	77	73	14	20	26	32	37	42	44	45	45	47	50	54	59			
	122	97	95	93	89	81	74	69	69	71	74	75	72	68	8	14	20	27	32	36	38	39	40	41	44	48	53	91		
	121	116	112	86	81	73	65	61	62	66	70	70	68	63	4	5	14	20	25	28	31	32	34	35	38	74	83	89		
	123	117	112	107	75	66	58	54	56	60	64	65	62	57	0	3	6	10	14	18	21	25	27	30	63	73	82	89		
132	125	118	111	104	98	93	52	48	49	53	57	58	55	50	-5	-2	-1	0	3	7	12	17	44	53	62	73	82	90	95		
135	127	118	110	102	96	91	86	80	43	46	48	49	47	43	-10	-9	-9	-9	-7	-3	32	38	45	53	62	72	82	91	97		
139	130	119	108	99	94	90	87	82	77	74	39	40	39	36	-17	-16	-17	-18	28	32	37	41	47	53	60	69	80	91	99		
143	133	121	109	99	94	91	89	85	80	77	76	32	32	31	-24	-23	-25	25	31	36	40	44	48	52	58	66	78	89	100		
147	136	123	111	102	96	94	91	88	84	80	77	72	65	25	-32	9	19	26	32	36	40	44	47	50	55	64	76	88	99		
149	138	126	114	105	100	97	94	90	86	82	76	69	59	-21	37	15	22	27	30	34	38	41	44	46	52	61	73	86	97		
150	139	128	116	108	102	98	94	90	86	81	75	-13	-12	-12	43	44	44	-26	27	30	35	39	41	44	49	59	71	83	93		
149	141	130	119	110	103	97	91	87	82	78	-6	-6	-5	-5	48	51	52	51	24	27	32	37	40	44	49	58	69	80	89		
147	141	132	122	112	103	95	88	82	8	4	1	1	1	0	54	59	61	60	57	55	30	36	41	46	52	60	69	77	85		
145	140	132	123	112	103	94	28	23	18	14	11	10	8	6	61	67	70	69	65	61	60	64	43	48	54	61	68	75	82		
	139	132	123	113	41	39	36	33	29	26	22	18	14	11	68	74	77	76	72	67	66	70	78	86	57	62	67	73			
	139	133	124	49	47	45	44	42	40	36	31	25	20	15	74	79	82	81	77	74	73	77	84	92	98	62	66	71			
	141	65	80	55	53	51	51	50	48	44	38	32	25	20	80	84	86	86	83	80	81	86	93	100	105	107	108	72			
		70	66	61	58	57	56	56	53	49	43	37	31	25	85	89	91	90	88	88	90	96	103	110	114	115	115				
			72	68	65	64	63	61	58	53	48	43	38	33	89	93	95	95	95	96	100	106	113	119	123	124					
				77	75	73	71	68	64	59	54	51	47	42	92	96	99	100	101	104	110	116	123	129	132						
					87	85	82	77	71	65	61	59	57	53	95	99	102	105	108	112	119	126	132	138							
						96	91	85	77	71	68	67	66	63	98	103	107	110	115	120	127	134	141								
							98	90	82	75	73	72	72	73	104	108	112	116	121	128	135	143									
										78	76	75	75	73	111	114	118	123	129												

FIGURE 32

Wavefront Plot-P Polarization

Task 2.2 - Nominal + Mfg. Error - On Axis

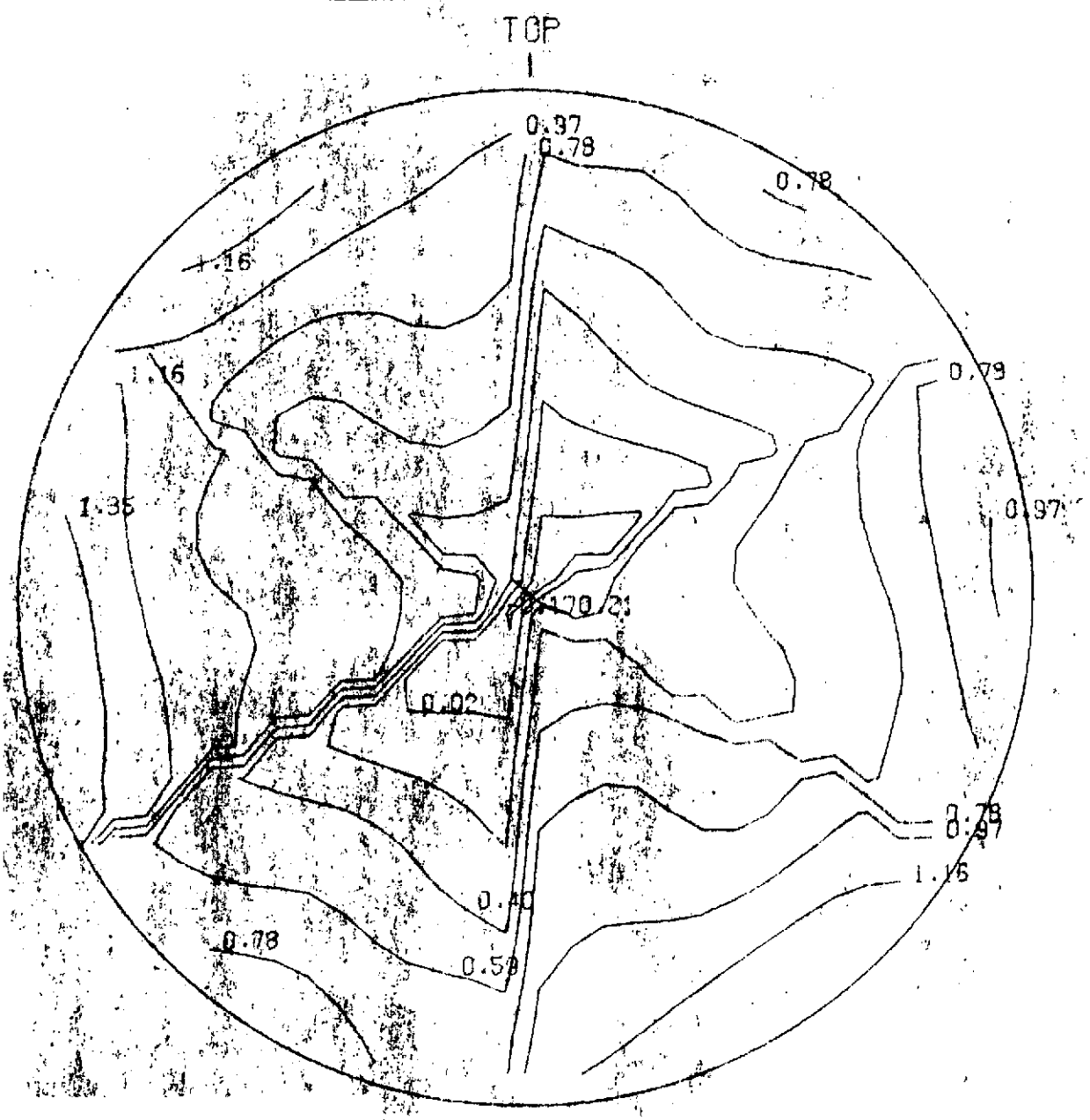

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FIGURE 33

Task 2.2 - Nominal + Mfg. Error - On Axis

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.02R6 = 100
TOTAL ENERGY = 3.2+61000D+01
MAP REPRESENTS 0.6314826D+01 OR 54.0604 PERCENT OF TOTAL ENERGY

```
 0  0  1  0  0  1  0  1  0  0  1  1  1  1  1  0  0  0  0  0  1  0  1  1  0  0  0  0  0  1  1  1  0  0
 0  0  1  1  1  0  0  0  0  1  1  1  1  1  1  1  1  0  0  0  0  1  1  1  1  1  1  0  0  0  0  1  1  0  0  0
 0  0  0  0  1  0  0  0  1  1  1  1  1  1  1  1  1  0  0  0  0  1  2  1  1  1  1  1  0  0  0  0  1  1  0  0  0
 0  0  0  0  0  0  0  1  1  1  1  0  1  1  1  1  1  0  0  0  1  2  2  1  1  1  1  1  1  1  1  1  0  0  0  0  0
 0  0  0  0  0  0  1  1  1  1  1  1  1  1  1  2  2  1  1  1  2  3  2  1  1  1  1  1  1  1  1  0  0  0  0  0
 0  0  0  0  1  0  1  1  2  2  1  2  1  1  3  4  5  3  1  1  1  2  1  1  1  0  1  2  1  0  0  0  0  0  0  0
 0  0  0  0  1  1  1  0  1  2  2  4  4  3  3  1  2  4  2  1  3  2  2  2  1  1  0  1  2  1  0  0  0  0  1  0
 1  0  0  0  1  1  1  1  2  2  5  7  6  5  5  4  2  1  2  5  6  3  2  3  2  0  1  1  1  1  0  0  0  0  0  0
 0  0  0  0  0  0  1  1  2  5  7  6  6  7  5  5  6  5  7  8  9  7  2  1  1  1  2  2  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  1  3  6  5  6  9  7  7 10 12 14 14 11  9  8  4  1  0  2  3  1  0  0  0  0  0  0  0  0
 0  0  0  0  0  1  1  2  4  2  3  8  6  6 17 17 15 25 26 26 25 15  6  3  1  2  2  0  0  0  0  1  0  0  0  0
 0  0  1  0  0  1  2  4  3  1  1  6 10 19 28 24 38 60 52 41 44 35 17  7  5  3  2  1  1  0  0  0  1  1  1  0
 1  1  1  0  1  2  2  4  4  3  2  5 16 28 29 38 69 94 82 53 46 40 21 14  9  3  1  1  1  1  1  1  0  1  1  1
 1  0  1  1  2  2  1  3  3  5  8  8 13 21 31 44 59 82 89 62 47 42 27 24 15  6  4  1  3  3  3  2  1  1  1  1
 0  1  1  2  2  2  2  3  2  2  8 11 12 18 32 38 48 88 97 52 28 33 35 30 15  9 10  4  5  5  3  2  1  1  1  1
 0  1  1  1  1  4  4  3  1  3  9 13 14 13 27 31 33 64 66 35 12 21 35 23  9  8 10  7  6  4  2  2  1  1  0  0
 1  1  1  1  1  5  5  3  2  9 14 15 23 15 25 30 12 12 12 23 27 40 46 19 10  8  5  8  6  3  1  2  2  1  0  0
 1  1  1  1  1  4  4  4  2  9 14 18 36 23 11 17  9  6  0  9 17 15 39 15 15  9  1  5  5  5  2  1  1  1  1  1
 1  1  1  2  2  3  3  5  5 10 21 23 32 19  5 16 17 12 12 15  5  7 12 11 23 10  1  1  3  5  2  1  0  1  1  1
 1  1  0  2  2  3  3  5 12 12 15 13 11 11 14 46 74 64 45 35 19  7  3  5 13  7  3  1  1  3  1  1  0  1  1  1
 1  1  0  2  2  2  3  4 12  8  4  6 16 40 51 70100 90 58 47 42 31 13  4  3  1  3  3  1  1  1  1  1  0  1  1
 1  1  1  3  2  1  2  2  5  2  6 20 38 73 92 92 94 83 64 62 54 37 21 14  8  1  1  2  2  2  2  1  1  1  1  1
 0  1  1  1  1  1  2  1  1  1 10 24 38 56 68 77 90 95 80 53 32 21 15 11  7  2  1  1  2  3  1  0  0  0  0  0
 0  1  1  0  0  0  1  2  2  3  7 12 21 30 35 41 54 60 48 31 21 14  8  3  1  1  1  2  1  1  0  0  1  0  0  0
 0  0  1  1  0  0  0  1  3  3  2  2  5 15 26 29 29 24 19 21 19  9  6  5  3  3  3  1  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  1  1  3  3  1  1  3  6 10 13 15 14  9  7  6  7 10  9  8  9  6  2  1  1  0  0  0  0  0  0
 0  0  0  0  0  0  0  1  3  3  2  2  4  6  5  5  6  5  4  3  5  8  9  9 10  8  5  2  1  1  0  0  1  0  0  0
 0  0  0  0  0  0  0  1  1  1  2  2  2  3  5  6  4  2  3  5  5  5  5  6  5  3  2  1  1  1  0  0  0  0  1  0
 1  1  0  0  0  1  2  2  1  0  0  1  2  2  3  3  3  4  3  3  3  3  3  1  1  0  1  1  1  1  0  0  0  0  0  0
 0  0  0  0  0  1  3  3  1  1  1  1  1  1  1  1  2  5  4  2  1  1  1  1  1  1  1  1  2  1  1  0  0  0  0  0  0
 0  0  0  0  1  1  2  2  2  1  1  1  1  1  1  0  0  1  2  2  1  1  1  1  1  1  1  1  1  1  0  0  0  0  0  0  0
 0  0  0  0  0  1  1  0  0  1  1  1  1  2  2  2  1  0  0  1  1  1  1  1  1  1  1  1  0  0  0  0  0  0  0  0  0
 0  0  0  0  1  1  0  0  0  1  1  1  1  2  2  1  0  0  0  1  1  1  1  1  1  1  1  0  0  0  0  0  1  1  1  0  0
 0  0  1  1  2  1  1  0  0  0  1  1  1  1  1  0  0  0  0  1  1  1  1  1  1  1  0  0  0  0  0  1  1  1  1  0  0
 0  0  0  1  1  1  1  1  0  0  0  0  0  0  0  0  0  0  0  0  1  1  1  1  0  0  0  0  1  1  1  1  0  0  0  0
10
10
```

FIGURE 34

Point Spread Function

Task 2.2 - Nominal + Mfg. Error - On Axis

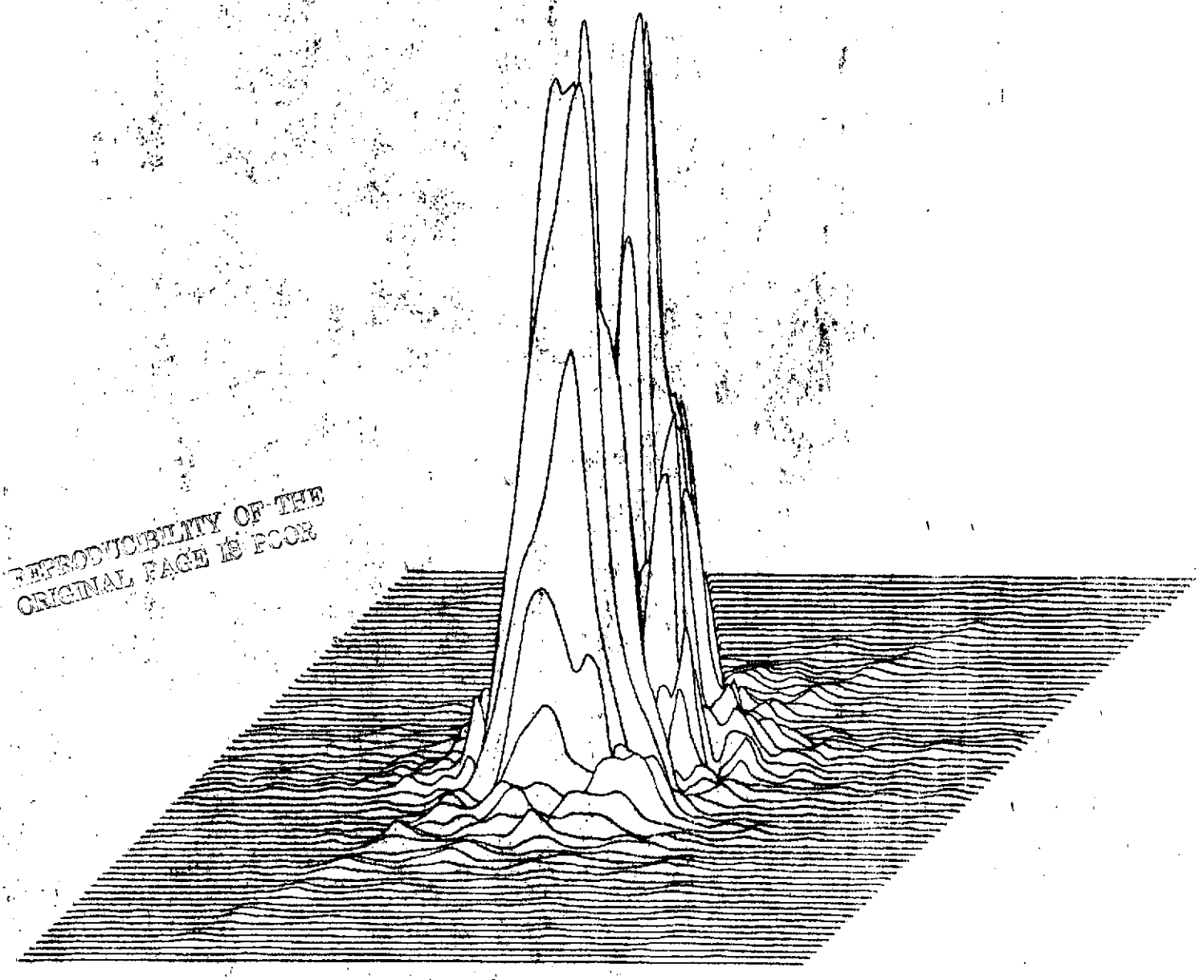

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FIGURE 35

Intensity Distriubtion - Central 129 Microradians

Task 2.2 - Nominal + Mfg. Error - On Axis

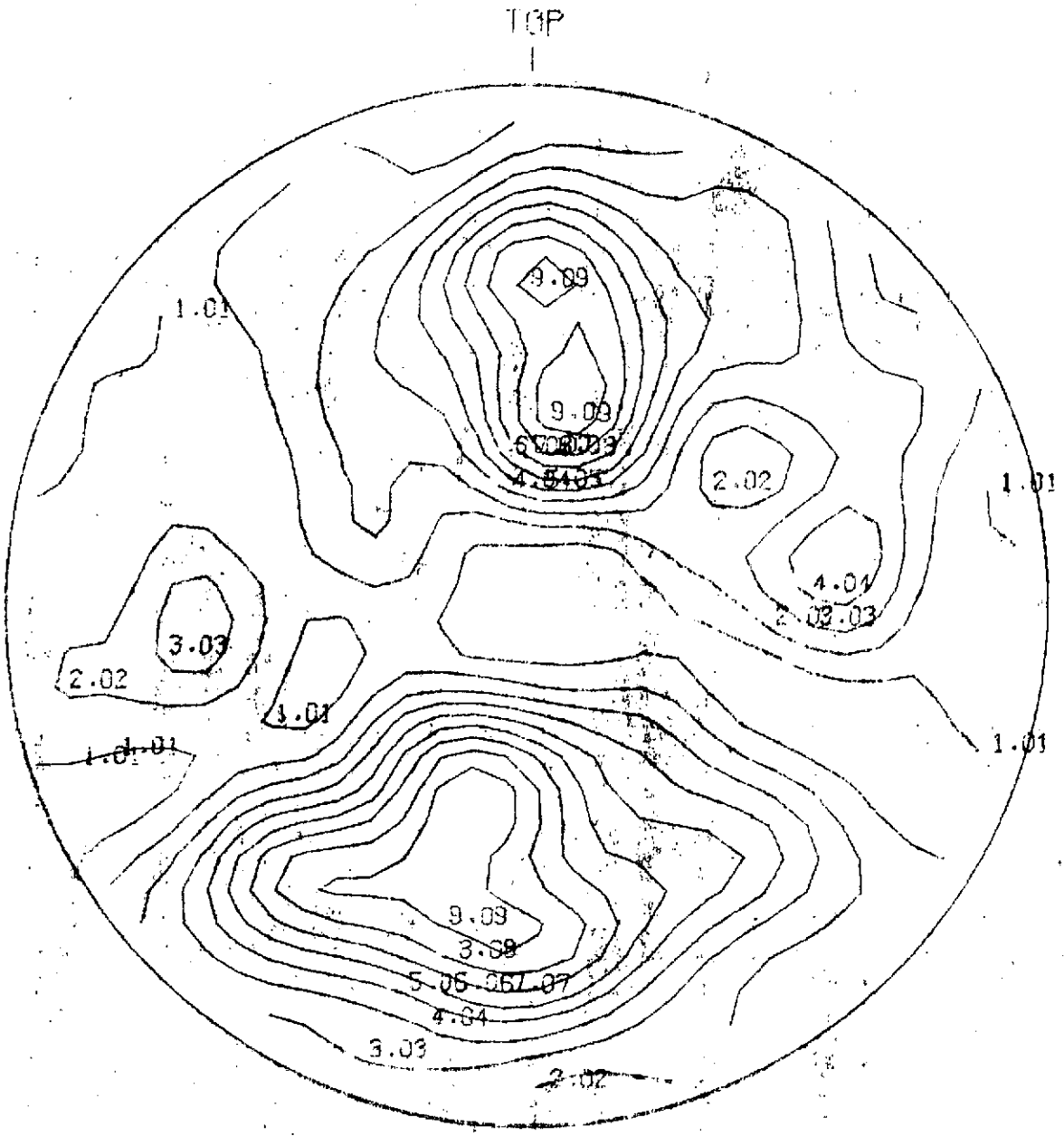
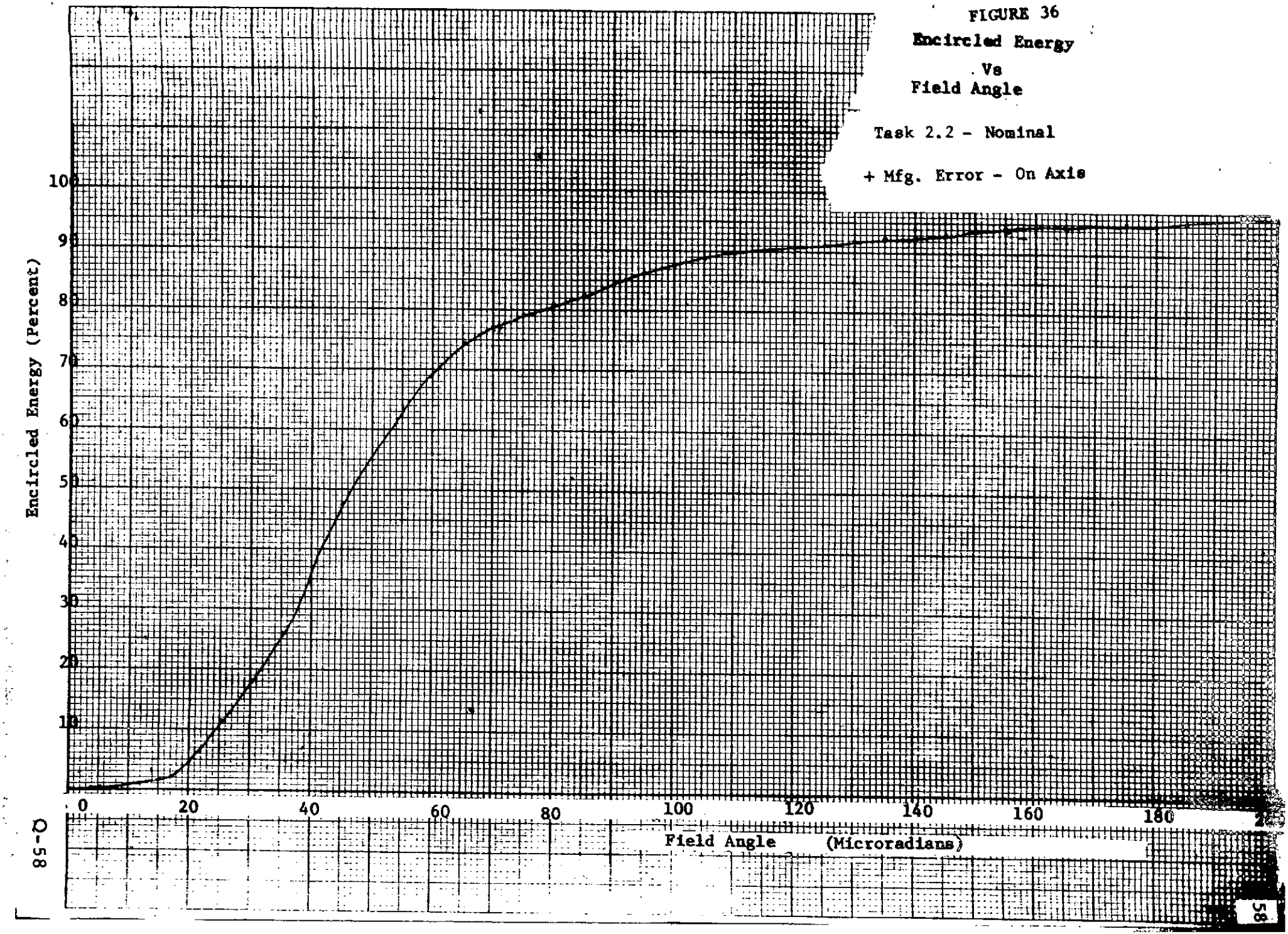


FIGURE 36
Encircled Energy
Vs
Field Angle

Task 2.2 - Nominal

+ Mfg. Error - On Axis



Q-58

TABLE 10

ENCIRCLED ENERGY

Task 2.2 - Nominal + Mfg. Error -15° Off Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.1	0.1	0.2	0.1	0.1	0.0	0.0
4.00	0.3	0.4	0.2	0.2	0.2	0.2	0.2	0.5	0.5
6.00	0.3	0.4	0.7	0.7	1.6	0.7	0.8	0.5	0.5
8.00	1.1	1.2	1.3	1.4	1.6	1.4	1.4	1.5	1.5
10.00	1.6	1.7	1.7	2.0	3.1	1.9	1.9	2.1	2.0
12.00	3.5	3.7	2.7	3.3	3.5	3.3	3.0	4.4	4.2
14.00	3.5	3.7	3.7	4.9	4.5	4.9	4.5	4.4	4.2
16.00	6.0	6.3	4.8	6.4	5.3	6.4	5.7	7.4	7.0
18.00	7.0	7.3	6.2	7.9	7.6	7.9	7.4	8.6	8.2
20.00	9.1	9.3	8.0	10.1	7.6	10.1	9.6	11.0	10.5
22.00	10.1	10.4	10.2	12.1	10.9	12.0	12.2	12.3	11.7
24.00	12.6	12.7	11.6	13.4	12.9	13.3	13.7	15.1	14.5
26.00	13.8	13.9	14.6	15.8	16.7	15.6	16.9	16.6	16.0
28.00	16.6	16.5	17.5	18.5	18.1	18.2	20.3	19.5	19.0
30.00	18.8	18.6	20.2	20.9	22.3	20.5	23.0	22.0	21.6
32.00	22.9	22.5	22.4	23.3	24.9	22.9	25.4	25.8	25.6
34.00	23.7	23.3	25.7	26.6	27.5	26.2	28.8	26.7	26.5
36.00	28.3	27.9	28.3	29.8	31.3	29.5	31.5	30.8	30.8
38.00	30.6	30.3	31.3	33.0	34.5	32.6	34.1	33.2	33.2
40.00	34.5	34.2	34.3	36.5	36.7	36.3	37.1	36.6	36.7
42.00	36.6	36.3	38.1	40.3	40.0	40.2	40.6	38.7	38.8
44.00	40.7	40.5	40.1	42.3	43.1	42.4	42.6	42.4	42.6
46.00	43.5	43.4	44.3	46.1	46.9	46.3	46.5	45.4	45.7
48.00	46.6	46.6	47.5	49.3	48.6	49.6	50.1	48.4	48.7
50.00	49.6	49.6	50.5	51.6	52.9	51.9	52.5	51.7	52.0
52.00	52.6	52.7	53.3	54.3	56.0	54.6	55.7	54.8	55.0
54.00	54.3	54.5	56.8	57.2	59.3	57.5	58.7	56.7	57.0
56.00	57.6	57.8	59.8	60.5	62.4	60.7	62.1	59.8	60.0
58.00	60.1	60.3	62.1	62.6	65.5	62.8	64.0	62.5	62.6
60.00	62.6	62.8	64.8	65.6	68.0	65.6	66.8	64.6	64.9
62.00	64.6	64.8	67.4	68.0	70.1	68.0	69.1	66.6	66.8
64.00	67.9	67.9	69.0	69.8	72.1	69.8	71.0	69.2	69.5
66.00	69.8	69.9	71.6	72.1	74.1	72.2	73.2	71.1	71.4
68.00	72.1	72.0	73.4	73.8	74.9	73.9	74.6	72.9	73.3
70.00	73.8	73.7	75.2	75.3	76.6	75.5	76.1	74.3	74.8
72.00	75.8	75.6	76.5	76.5	77.9	76.7	77.2	75.9	76.3
74.00	76.7	76.6	78.2	77.9	79.1	78.2	78.4	76.9	77.3
76.00	78.5	78.3	79.5	79.1	80.1	79.3	79.4	78.3	78.6
78.00	79.6	79.5	80.2	80.0	81.1	80.2	80.1	79.3	79.5
80.00	80.6	80.6	81.4	81.0	81.8	81.1	81.0	80.3	80.4

TABLE 11

ENCIRCLED ENERGY

Task 2.2 - Nominal + Mfg. Error - -15° Off Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.3	0.4	0.7	0.6	0.9	0.6	0.7	0.5	0.5
10.00	1.6	1.7	1.7	2.0	3.1	1.9	1.9	2.1	2.0
15.00	5.0	5.3	4.4	5.8	5.3	5.8	5.2	6.2	5.9
20.00	9.1	9.3	8.0	10.1	7.6	10.1	9.6	11.0	10.5
25.00	13.4	13.5	14.1	15.3	14.1	15.2	16.5	16.1	15.5
30.00	18.8	18.6	20.2	20.9	22.3	20.5	23.0	22.0	21.6
35.00	26.6	26.2	26.6	27.8	30.3	27.4	29.5	29.0	28.9
40.00	34.5	34.2	34.3	36.5	36.7	36.3	37.1	36.6	36.7
45.00	42.0	41.9	42.7	44.6	44.6	44.8	45.0	43.9	44.2
50.00	49.6	49.6	50.5	51.6	52.9	51.9	52.5	51.7	52.0
55.00	56.5	56.7	58.0	58.7	61.7	58.9	60.2	58.7	58.8
60.00	62.6	62.8	64.8	65.6	68.0	65.6	66.8	64.6	64.9
65.00	68.7	68.7	70.7	71.3	73.1	71.4	72.4	70.0	70.3
70.00	73.8	73.7	75.2	75.3	76.6	75.5	76.1	74.3	74.8
75.00	77.9	77.7	78.7	78.5	79.7	78.7	78.9	77.7	78.1
80.00	80.6	80.6	81.4	81.0	81.8	81.1	81.0	80.3	80.4
85.00	82.5	82.6	83.3	83.1	83.5	83.1	82.9	82.4	82.3
90.00	84.1	84.2	84.6	84.6	84.8	84.5	84.4	84.2	84.0
95.00	85.4	85.6	85.7	85.8	85.9	85.7	85.7	85.7	85.5
100.00	86.5	86.6	86.6	86.7	86.9	86.7	86.9	86.8	86.7
105.00	87.4	87.4	87.6	87.7	87.8	87.7	87.8	87.6	87.6
110.00	88.3	88.3	88.5	88.5	88.7	88.6	88.6	88.4	88.5
115.00	89.2	89.2	89.3	89.2	89.4	89.3	89.3	89.2	89.3
120.00	89.9	89.9	90.0	89.9	90.1	90.0	89.9	89.8	89.9
125.00	90.5	90.5	90.6	90.5	90.7	90.6	90.4	90.3	90.3
130.00	91.0	91.0	91.1	91.1	91.1	91.1	90.9	90.9	90.8
135.00	91.4	91.4	91.4	91.5	91.5	91.5	91.5	91.5	91.5
140.00	91.9	91.8	91.9	91.9	91.9	91.9	91.9	91.9	91.9
145.00	92.3	92.3	92.3	92.3	92.2	92.3	92.2	92.2	92.2
150.00	92.7	92.7	92.7	92.7	92.7	92.6	92.6	92.6	92.6
155.00	93.0	93.1	93.1	93.1	93.1	93.0	93.0	93.0	92.9
160.00	93.4	93.4	93.4	93.4	93.4	93.4	93.3	93.4	93.4
165.00	93.8	93.7	93.8	93.8	93.8	93.8	93.8	93.8	93.8
170.00	94.1	94.0	94.0	94.1	94.2	94.1	94.1	94.1	94.1
175.00	94.4	94.3	94.4	94.4	94.4	94.4	94.4	94.4	94.4
180.00	94.7	94.7	94.7	94.7	94.8	94.7	94.8	94.7	94.7
184.99	95.0	95.0	95.0	94.9	94.9	95.0	95.0	95.0	95.0
189.99	95.2	95.3	95.3	95.2	95.3	95.3	95.2	95.2	95.2
194.99	95.5	95.5	95.6	95.5	95.6	95.5	95.5	95.5	95.4
199.99	95.8	95.8	95.8	95.8	95.8	95.8	95.7	95.8	95.7

FIGURE 37

Wavefront Map-() Polarization

Task 2.2 - Nominal + Mfg. Error -15° Off Axis

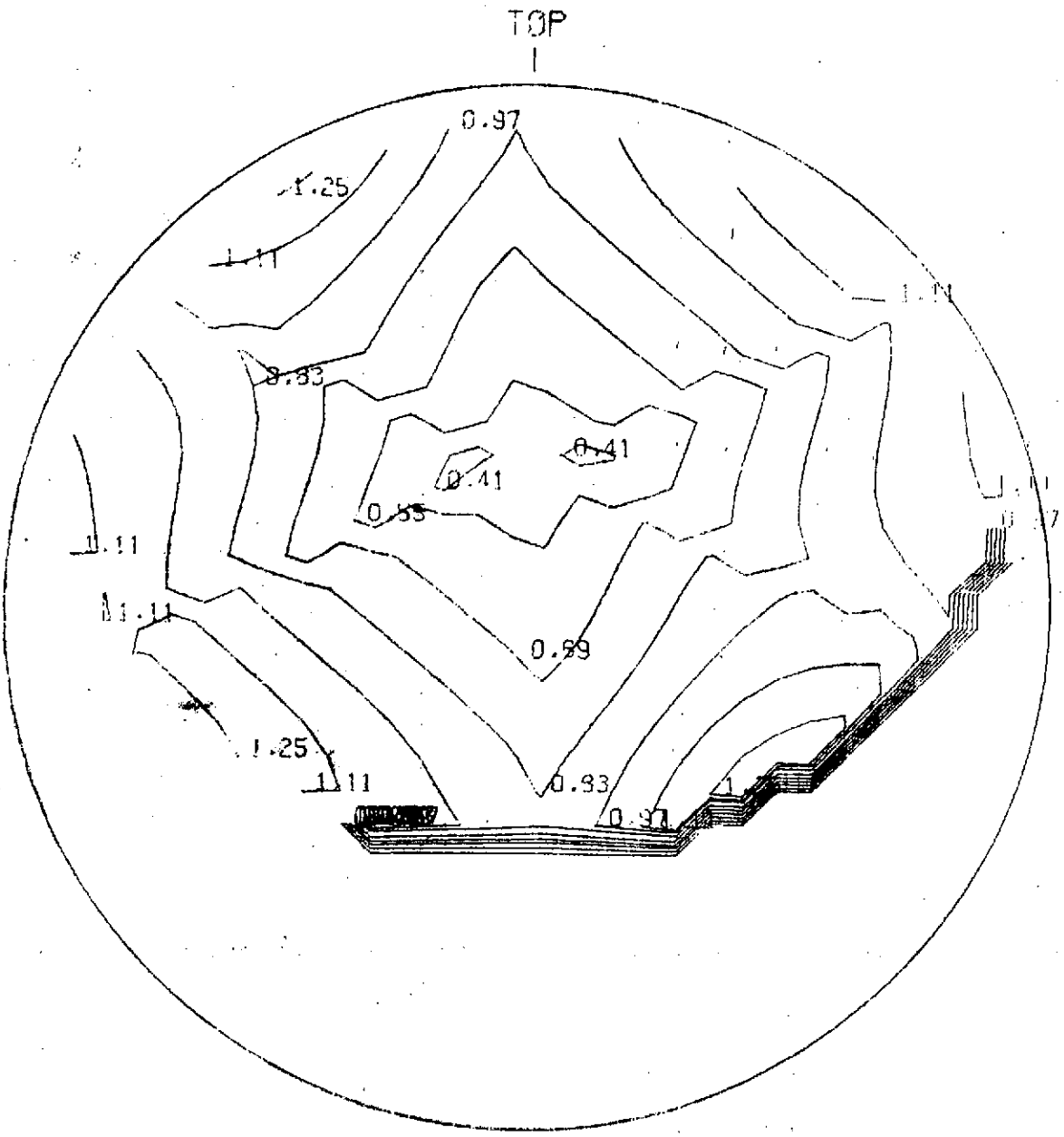
MAP IN UNITS OF 0.01 WAVES

```
                                                    95  88  94  98
                                            127 117 107  98  90  83  90  94  98 102 107 111
                                        136 130 122 112 103  94  86  81  87  91  95 100 109 110 115 120
                                    132 128 122 115 106  97  89  82  77  83  87  92  97 102 108 113 118 124
                            125 124 122 119 114 107  99  91  84  77  72  78  82  87  92  97 103 108 114 119 125 130
                        114 114 114 113 110 106 100  93  86  79  72  68  73  77  82  86  92  97 102 108 113 119 124 130
                    106 106 106 106 103  99  94  88  81  74  68  63  68  72  76  81  85  90  96 101 106 112 118 124
                97  92  88 101 100  98  94  90  84  77  71  65  60  63  67  71  75  80  84  89  95 100 106  95 103 111
            104 100  96  92  87  82  94  90  86  80  74  68  62  57  59  62  66  70  74  79  83  89  79  87  95 103 113 116
            107 103  99  95  90  85  78  72  65  77  71  65  59  54  55  58  61  65  69  56  64  72  81  88  96 103 109 115
        114 110 106 102  97  92  86  79  72  65  57  51  62  56  50  51  53  56  44  51  59  67  75  83  90  97 103 108 113 118
        116 112 108 103  98  92  85  78  71  63  55  48  42  36  46  46  34  40  47  54  62  69  77  85  92  98 103 108 112 117
        117 113 108 103  98  91  84  76  68  60  53  45  39  51  48  48  54  43  50  56  64  71  79  86  92  98 103 107 111 115
            114 109 103  96  89  82  74  65  57  50  62  58  55  53  52  58  64  69  58  65  72  79  85  91  97 101 105 109
            115 109 103  96  88  80  72  63  75  71  67  63  60  57  55  61  67  73  79  84  71  77  84  89  94  98 102 106
                110 103  95  87  97  91  86  81  76  72  68  64  61  58  63  69  76  82  87  92  96  98  86  90  94  99
                112 104 114 109 103  97  92  87  82  77  73  69  65  61  66  72  79  85  91  96 100 102 103 103  91  96
                    127 121 115 109 104  99  93  88  83  78  74  70  65  70  76  83  90  96 102 106 109 110 110 109
                        127 122 116 110 105 100  94  89  84  79  75  70  75  81  88  96 103 109 114 117 118 119
                            127 121 116 111 105 100  94  89  85  80  75  79  86  94 102 110 117 123 126 129
                                125 120 114 109 104  99  94  89  84  79  84  91 100 109 118 126 132 136
                                    116 111 106 101  97  92  88  82  88  96 105 115 124 133
                                        108 103  99  95  91  85  91 100 109 119
```

FIGURE 38

Wavefront Plot-Q Polarization

Task 2.2 - Nominal + Mfg. Error -15° Off Axis



F 37

63

FIGURE 39

Wavefront Map-F Polarization

Task 2.2 - Nominal + Mfg. Error -15° Off Axis

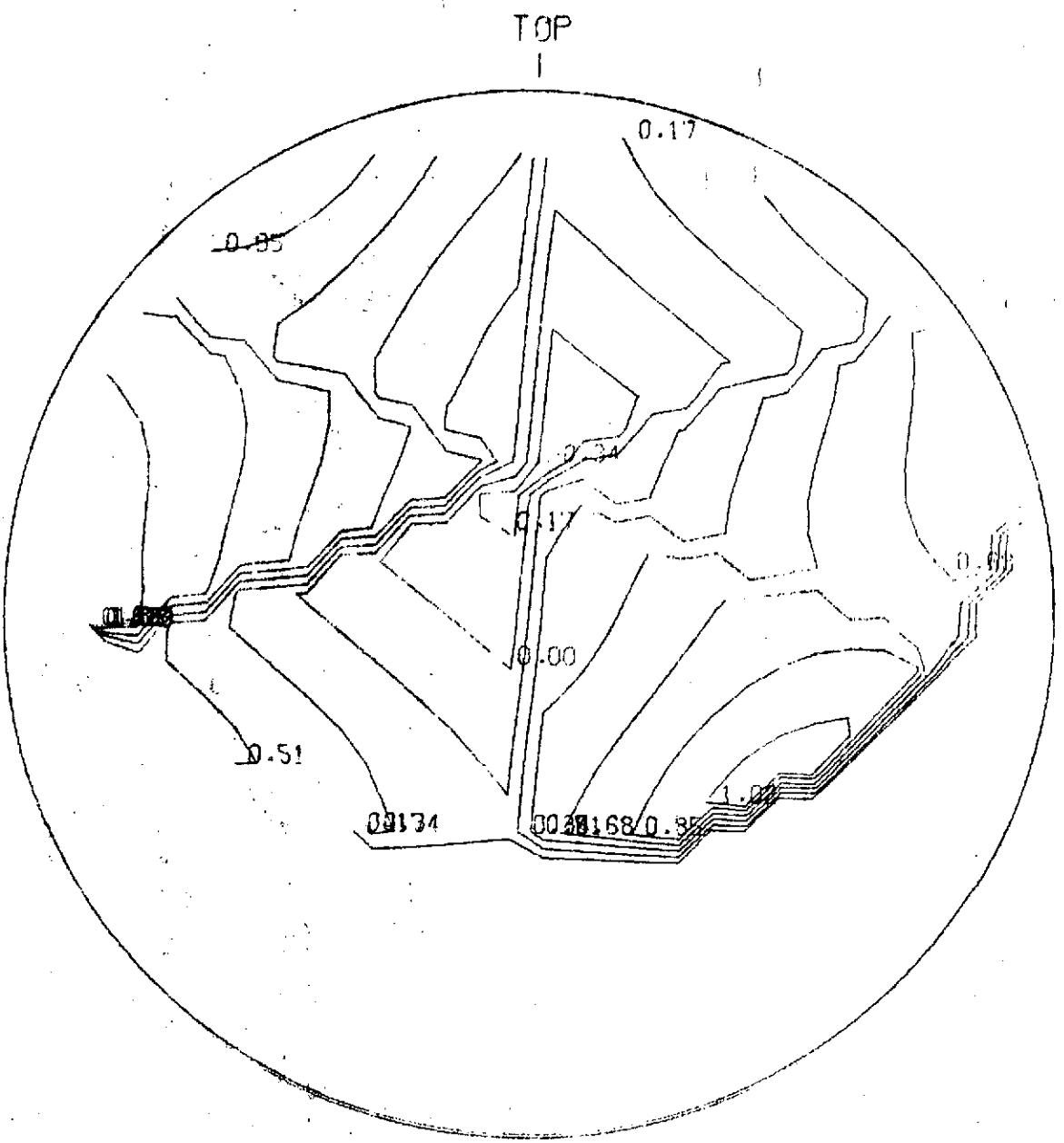
MAP IN UNITS OF 0.01 WAVES

```
                                                64  58  14  18
                                        97  87  77  67  59  53   9  13  17  22  26  31
                                    106 99  91  82  72  63  56  50   6  10  15  20  25  30  35  40
                                101 97  91  84  76  67  59  52  46   2   7  11  17  22  27  32  38  43
                            94  93  92  88  83  76  69  61  53  47  42  -2   2   7  12  17  22  28  33  39  44  50
                        84  84  84  82  80  75  69  63  55  48  42  37  -7  -3   1   6  11  16  22  27  33  38  44  50
                    76  76  76  75  73  69  64  57  51  44  38  33 -12  -8  -3   0   5  10  15  21  26  32  37  43
                113 109 105 71  70  68  64  59  53  47  40  35  29 -16 -13  -9  -4   0   4   9  14  20  25  62  70  78
            121 117 113 109 104 99  63  60  55  50  44  38  32  26 -20 -17 -14 -10  -6  -1   3   8  46  54  62  70  77  83
            124 120 116 112 107 101 95  88  81  46  41  35  29  23 -24 -22 -18 -15 -11  23  31  39  47  55  63  70  76  82
        130 126 123 119 114 109 102 96  88  81  74  67  31  26  20 -29 -26 -23  11  18  26  34  42  50  57  64  70  75  80  85
        132 128 124 120 115 109 102 95  87  80  72  65  58  52  15 -34   1   7  14  21  28  36  44  52  59  65  70  75  79  84
        134 129 125 120 114 108 100 93  85  77  69  62  55 -20 -22  27  33  13  16  23  31  38  46  53  59  65  70  74  78  82
            131 125 119 113 106 98  90  82  74  66  -8 -12 -15 -17  31  37  42  48  25  32  39  46  52  58  63  68  72  75
            132 126 119 112 104 96  88  80   4   0  -3  -7 -10 -13  34  40  46  52  57  63  38  44  50  56  61  65  69  73
                127 120 112 104 26  20  15  10   5   1  -2  -6  -9  37  42  48  55  61  66  71  75  77  53  57  61  65
                129 121  43  38  32  26  21  16  11   6   2  -1  -5  40  45  51  58  64  70  75  79  81  82  82  58  63
                    56  50  44  38  33  27  22  17  12   7   3   0  44  49  55  62  69  75  81  85  88  89  89  88
                        56  50  45  39  34  29  23  18  13   8   4  49  53  60  67  75  82  88  93  96  97  98
                            56  50  45  39  34  29  23  18  13   9  53  58  65  73  81  89  96 102 105 107
                                54  48  43  38  33  28  23  18  13  58  63  70  79  88  97 105 111 115
                                    45  40  35  30  26  21  17  61  67  75  84  94 103 112
                                        36  32  28  24  20  64  70  79  88  98
```

FIGURE 40

Wavefront Plot-P Polarization

Task 2.2 - Nominal + Mfg. Error -15° Off Axis



REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

FIGURE 41

Task 2.2 - Nominal + Mfg. Error -15° Off Axis

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0179 = 100
TOTAL ENERGY = 0.18704000+01
MAP REPRESENTS 0.17430360+01 OR 93.1906 PERCENT OF TOTAL ENERGY

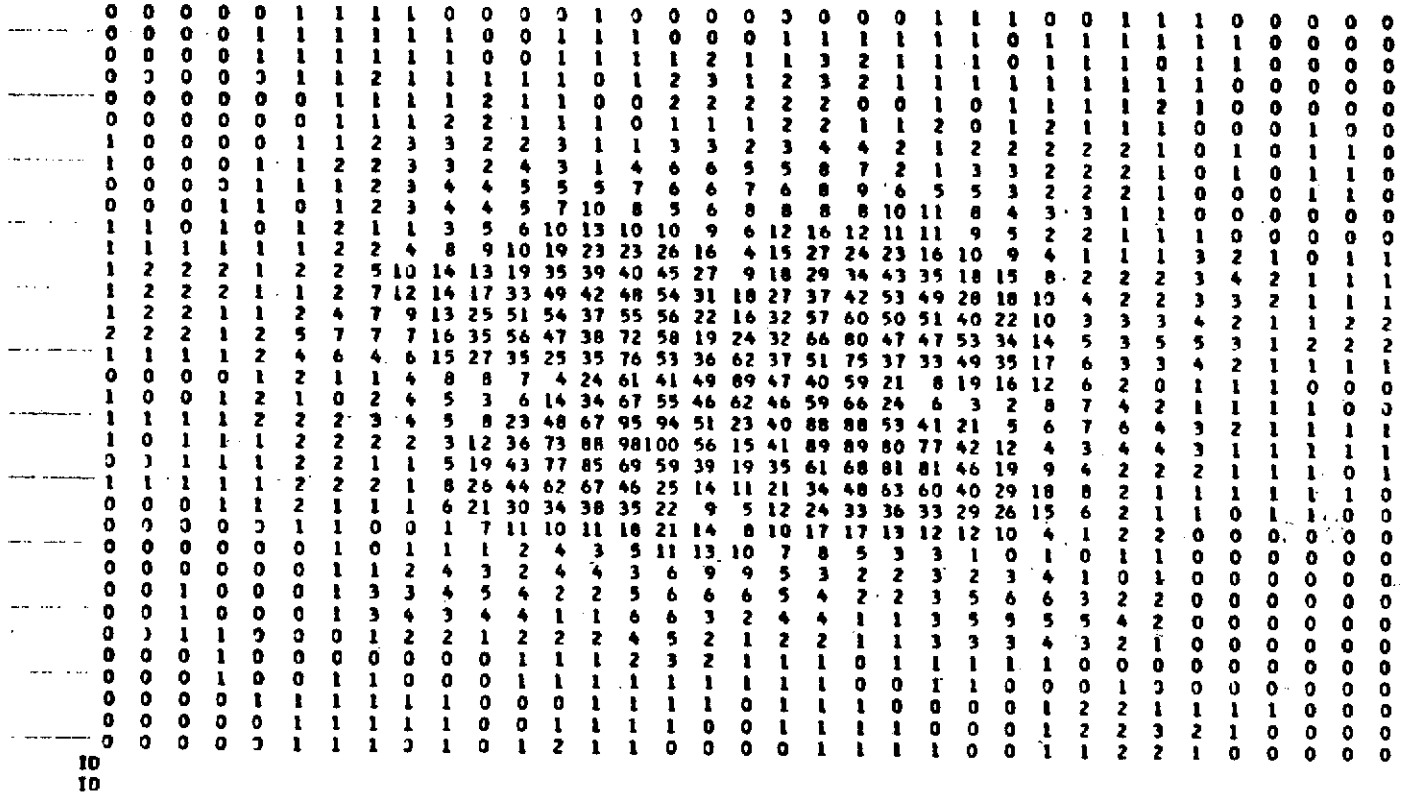


FIGURE 42

Point Spread Function

Task 2.2 - Nominal + Mfg. Error -15° Off Axis

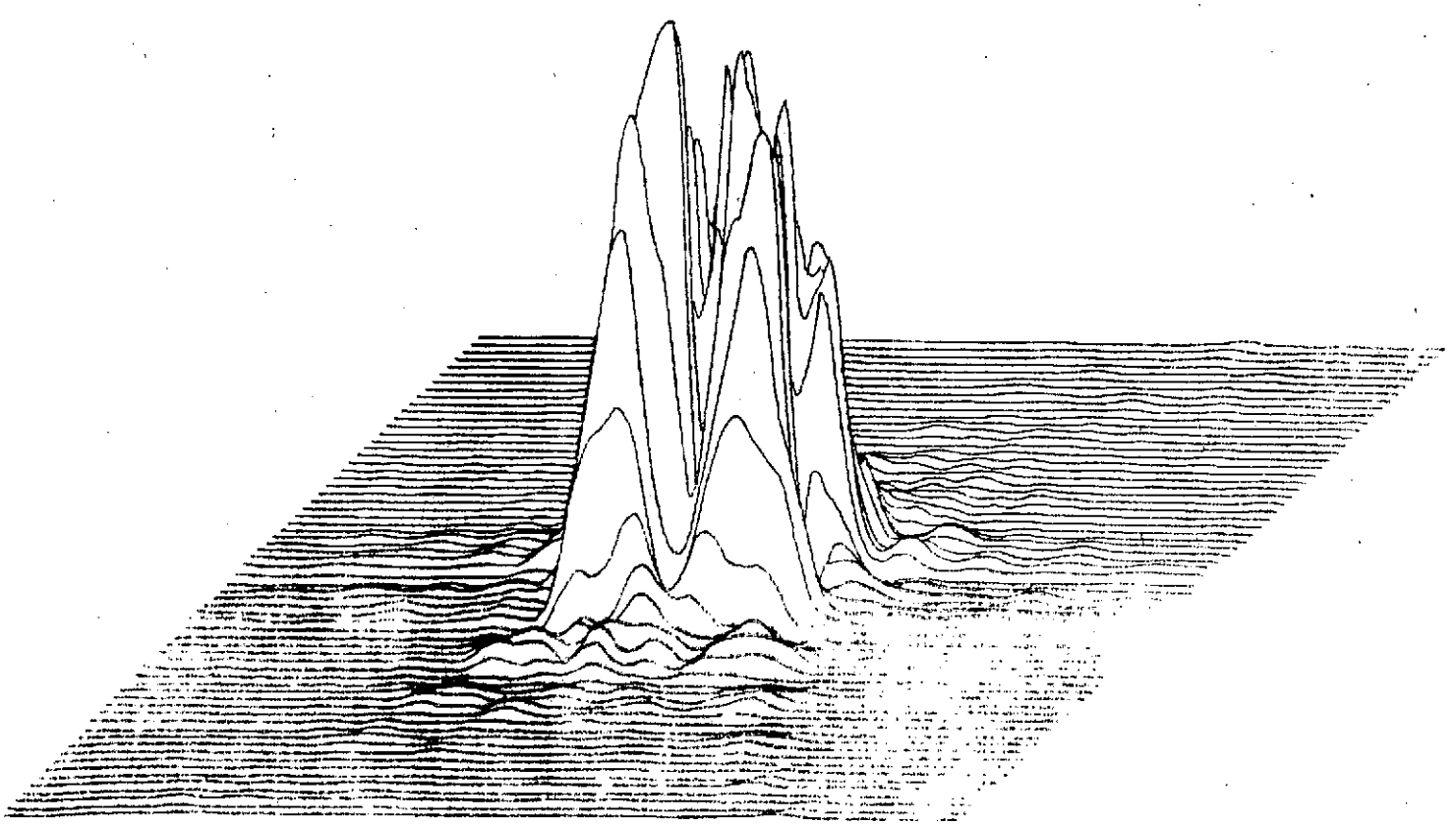


FIGURE 43

Intensity Distriubtion - Central 129 Microradians

Task 2.2 - Nominal + Mfg. Error -15° Off Axis

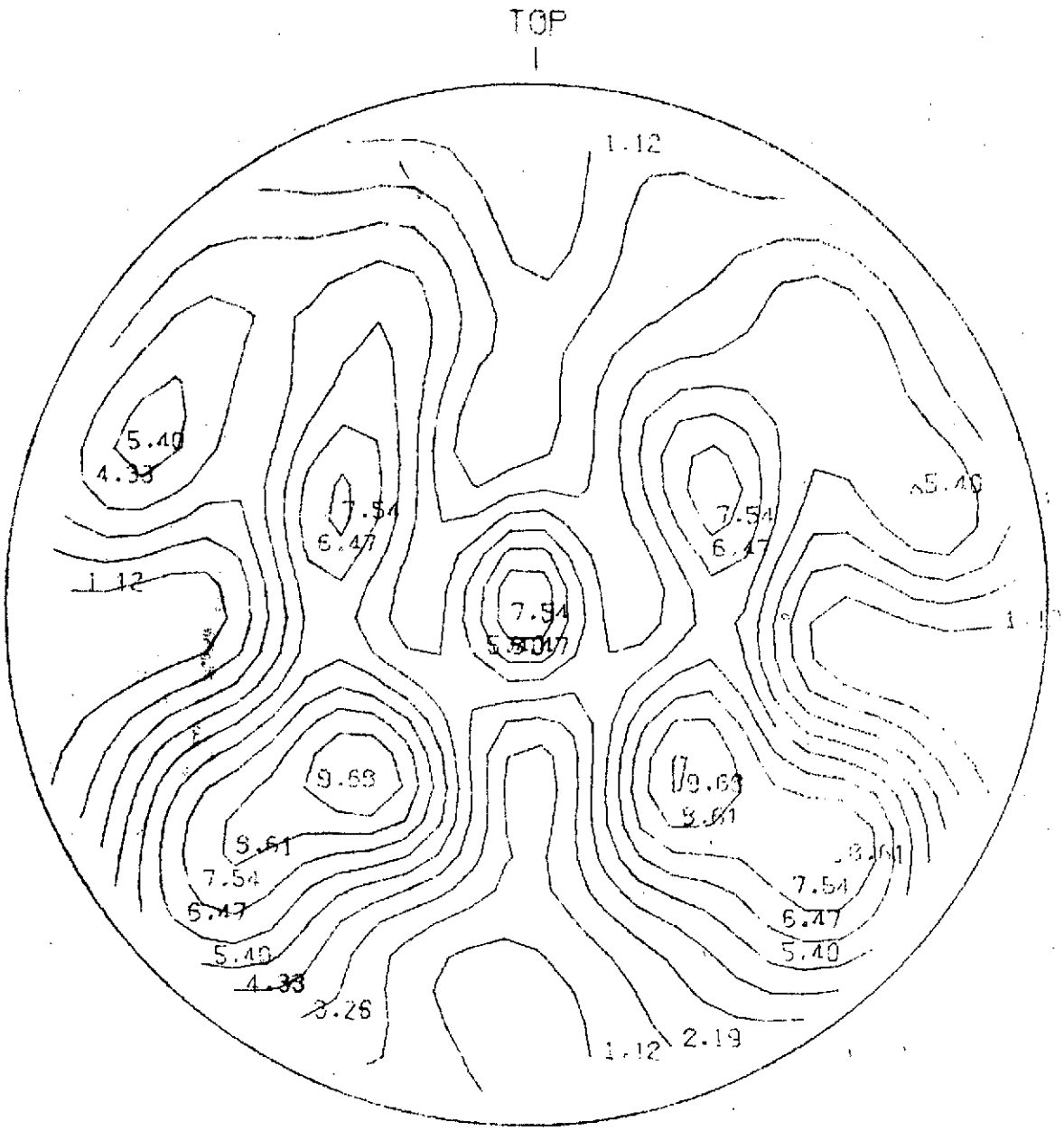


FIGURE 44

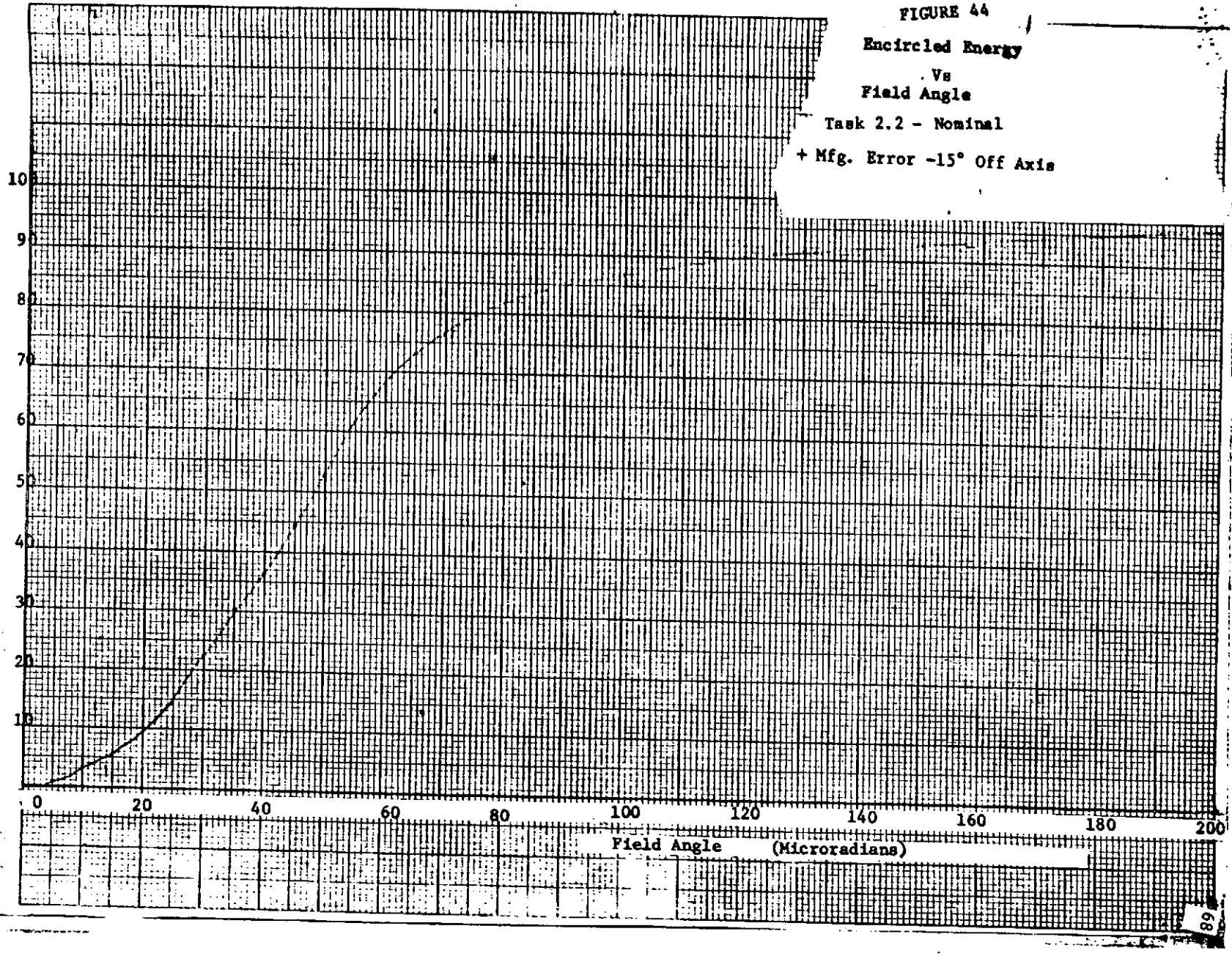
Encircled Energy

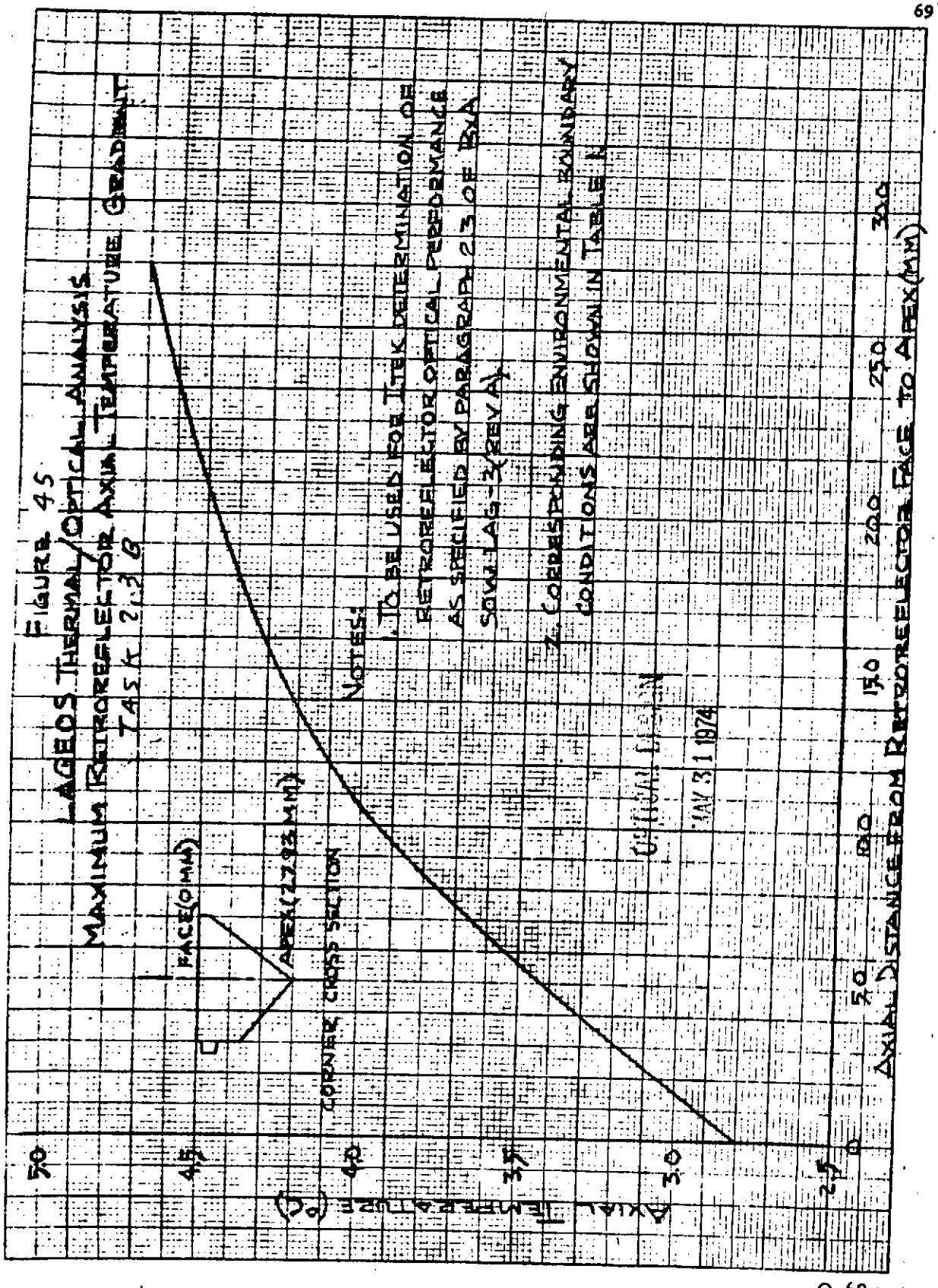
Vs

Field Angle

Task 2.2 - Nominal

+ Mfg. Error -15° Off Axis





Q-69

REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

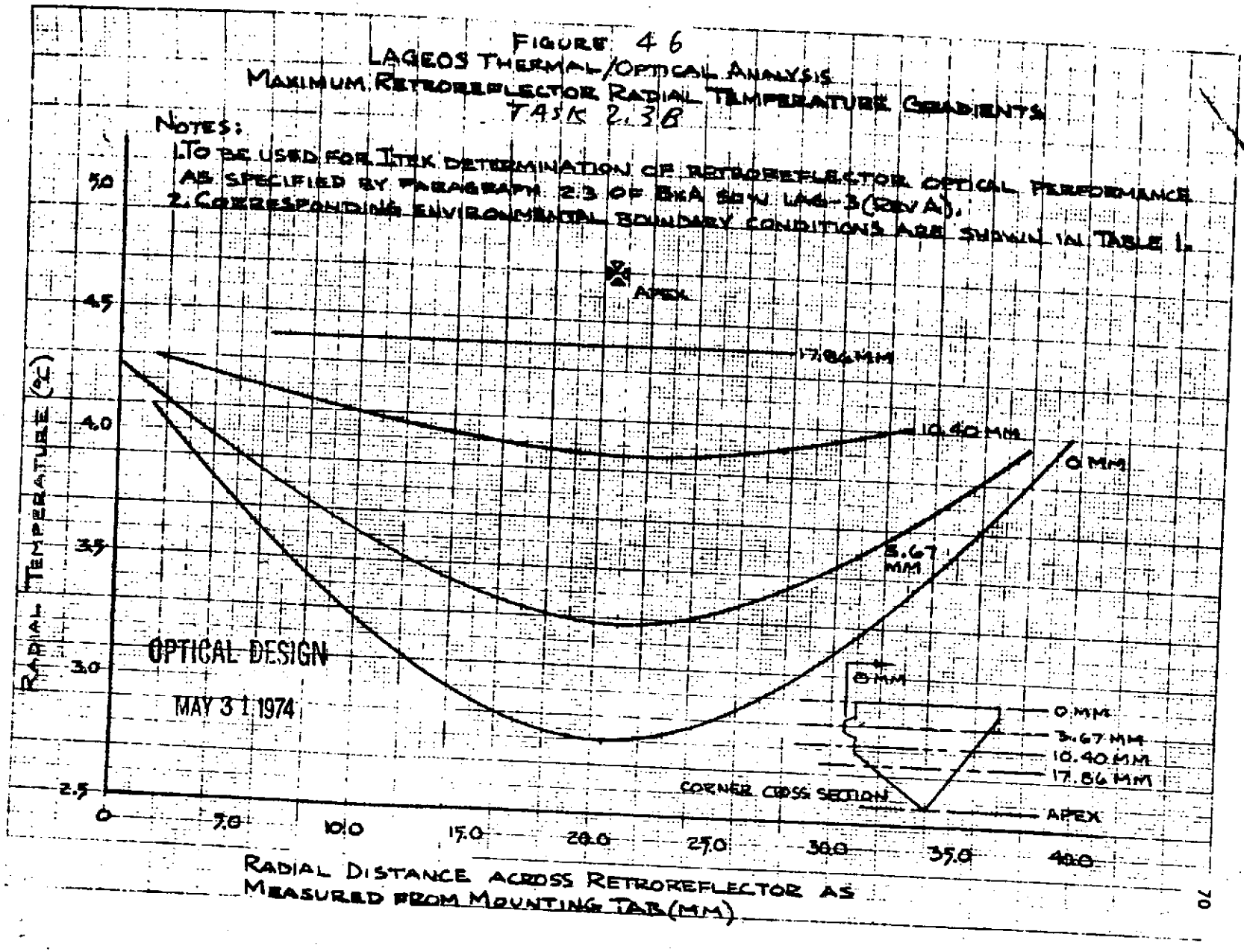


FIGURE 46
LAGEOS THERMAL/OPTICAL ANALYSIS
MAXIMUM RETROREFLECTOR RADIAL TEMPERATURE GRADIENTS
TASK 2.3B
NOTES:
1. TO BE USED FOR ITEK DETERMINATION OF RETROREFLECTOR OPTICAL PERFORMANCE AS SPECIFIED BY PARAGRAPH 2.3 OF BKA SOW LAG-3 (REV A).
2. CORRESPONDING ENVIRONMENTAL BOUNDARY CONDITIONS ARE SHOWN IN TABLE I.
APEX
17.84 MM
10.40 MM
5.67 MM
0 MM
OPTICAL DESIGN
MAY 3 1 1974
RADIAL TEMPERATURE (°C)
5.0
4.5
4.0
3.5
3.0
2.5
0
7.0
10.0
17.0
20.0
25.0
30.0
35.0
40.0
70
CORNER CROSS SECTION
0 MM
3.67 MM
10.40 MM
17.84 MM
APEX
RADIAL DISTANCE ACROSS RETROREFLECTOR AS MEASURED FROM MOUNTING TAB (MM)

EAG 5-28-74

FIGURE 47

LAGEOS THERMAL/OPTICAL ANALYSIS

MAXIMUM RETROREFLECTOR AXIAL TEMPERATURE GRADIENT

TASK 2.3A.1

OPTICAL DESIGN

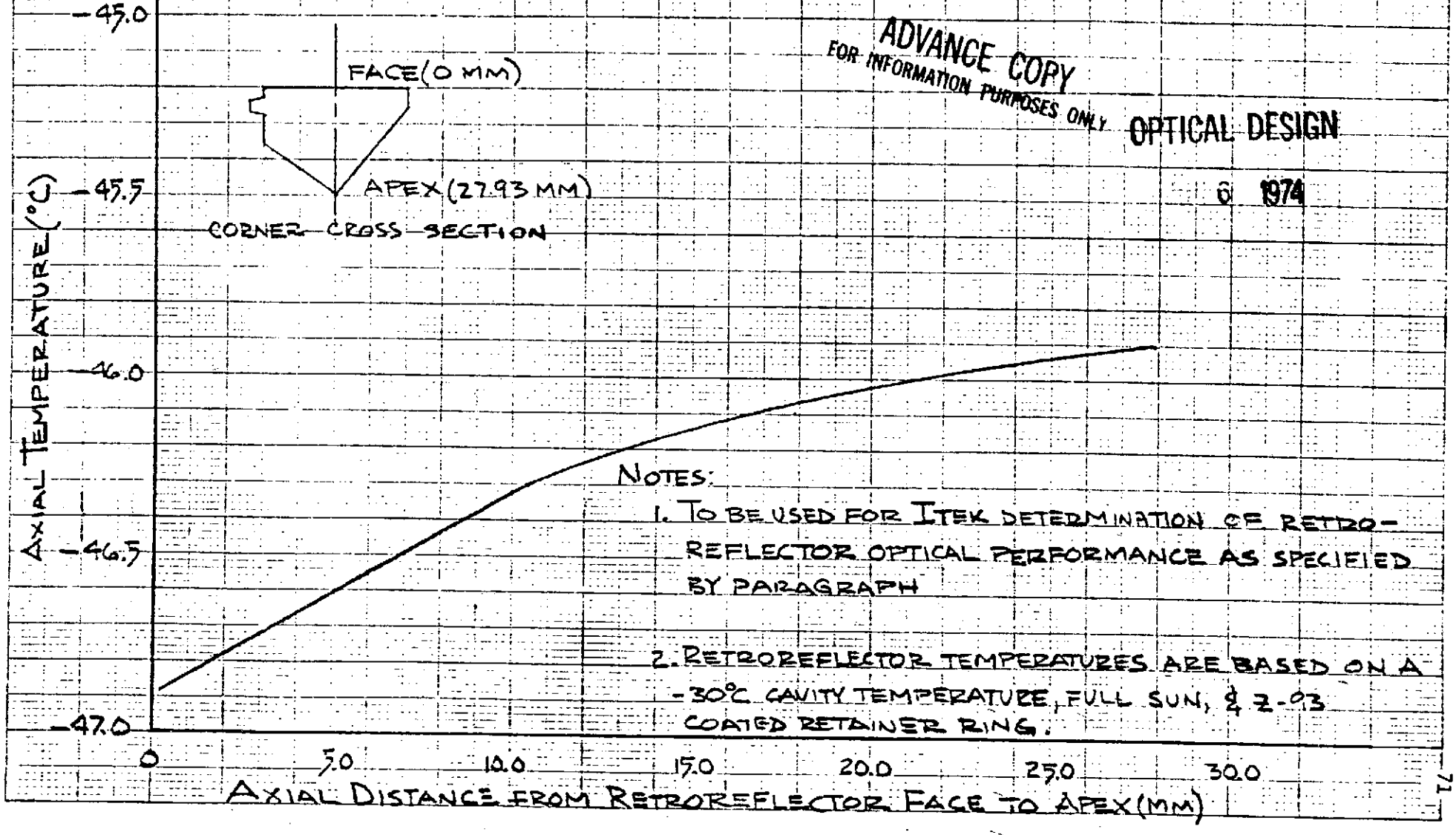
JUN 6 1974

ADVANCE COPY
FOR INFORMATION PURPOSES ONLY

OPTICAL DESIGN

6 1974

CORNER CROSS-SECTION



NOTES:

1. TO BE USED FOR ITEK DETERMINATION OF RETRO-REFLECTOR OPTICAL PERFORMANCE AS SPECIFIED BY PARAGRAPH

2. RETROREFLECTOR TEMPERATURES ARE BASED ON A -30°C CAVITY TEMPERATURE, FULL SUN, & Z-93 COATED RETAINER RING.

FIGURE 48

LAGEOS THERMAL/OPTICAL ANALYSIS

MAXIMUM RETROREFLECTOR RADIAL TEMPERATURE GRADIENTS

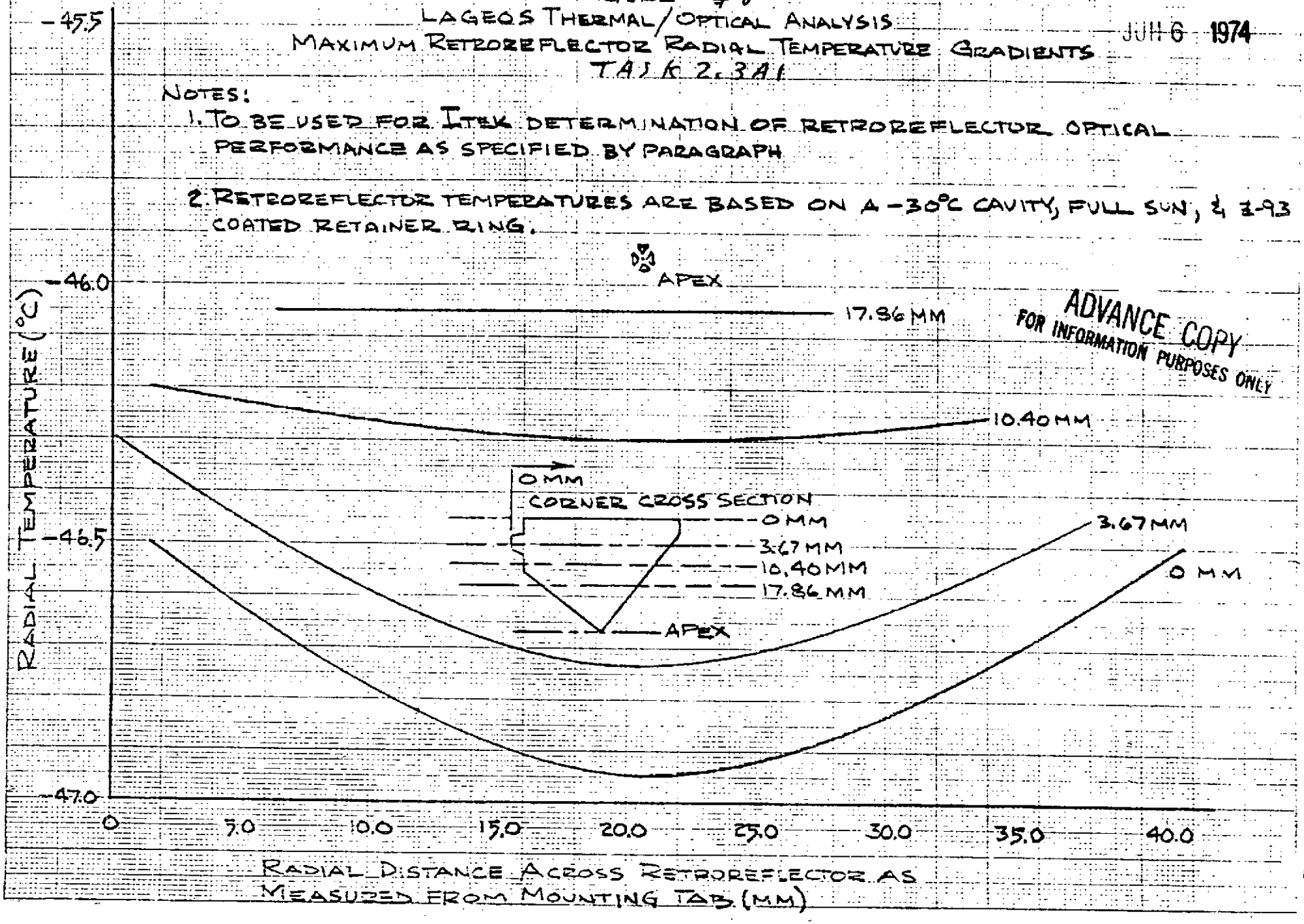
TASK 2.3A1

JUN 6 1974

NOTES:

1. TO BE USED FOR ITEK DETERMINATION OF RETROREFLECTOR OPTICAL PERFORMANCE AS SPECIFIED BY PARAGRAPH

2. RETROREFLECTOR TEMPERATURES ARE BASED ON A -30°C CAVITY, FULL SUN, & Z-93 COATED RETAINER RING.



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EPG 3-3-74

FIGURE 49

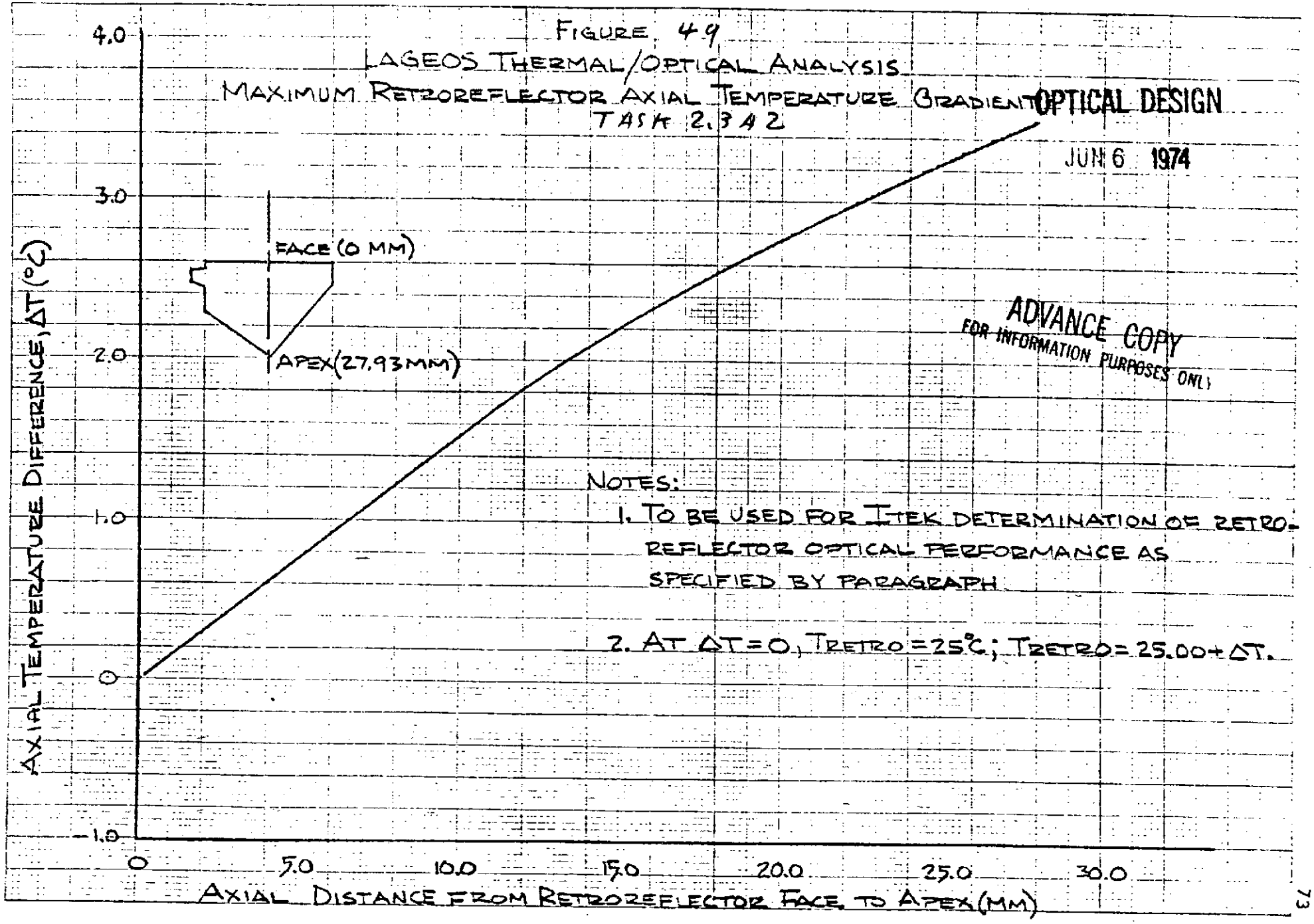
LAGEOS THERMAL/OPTICAL ANALYSIS

MAXIMUM RETROREFLECTOR AXIAL TEMPERATURE GRADIENT

TASK 2.3.4.2

OPTICAL DESIGN

JUN 6 1974



ADVANCE COPY

FOR INFORMATION PURPOSES ONLY

NOTES:

1. TO BE USED FOR ITEK DETERMINATION OF RETRO-REFLECTOR OPTICAL PERFORMANCE AS SPECIFIED BY PARAGRAPH

2. AT $\Delta T = 0$, $T_{RETRO} = 25°C$; $T_{RETRO} = 25.00 + \Delta T$.

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

FIGURE 50

LAGEOS THERMAL/OPTICAL ANALYSIS

MAXIMUM RETROREFLECTOR RADIAL TEMPERATURE GRADIENTS

TASK 2.3.4.2

NOTES:

1. TO BE USED FOR ITEK DETERMINATION OF RETROREFLECTOR OPTICAL PERFORMANCE AS SPECIFIED BY PARAGRAPH
2. AT $\Delta T = 0$, $T_{RETRO} = 25°C$; $T_{RETRO} = 25.00 + \Delta T$.

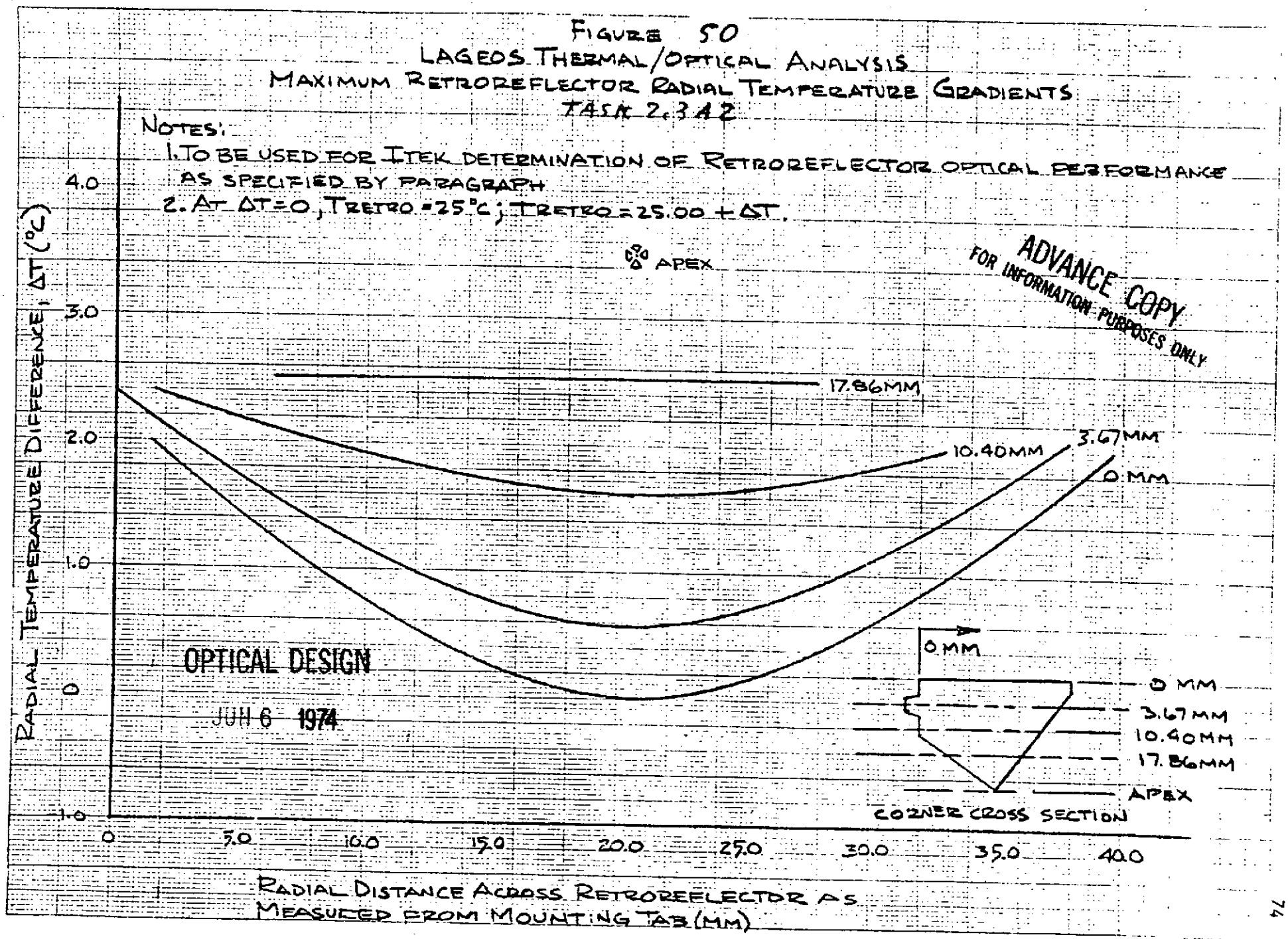


FIGURE 51

LAGEOS THERMAL/OPTICAL ANALYSIS

RETROREFLECTOR UNIT AXIAL TEMPERATURE GRADIENT

TASK 2.5A

NOTES:

1. TO BE USED FOR ITEK DETERMINATION OF RETROREFLECTOR OPTICAL PERFORMANCE AS SPECIFIED BY CASE 2.5.9 OF LAGEOS-27, DATED 6-3-74.
2. AT $\Delta T = 0$, $T_{RETRO} = 25°C$; $T_{RETRO} = 25.00 + \Delta T$.

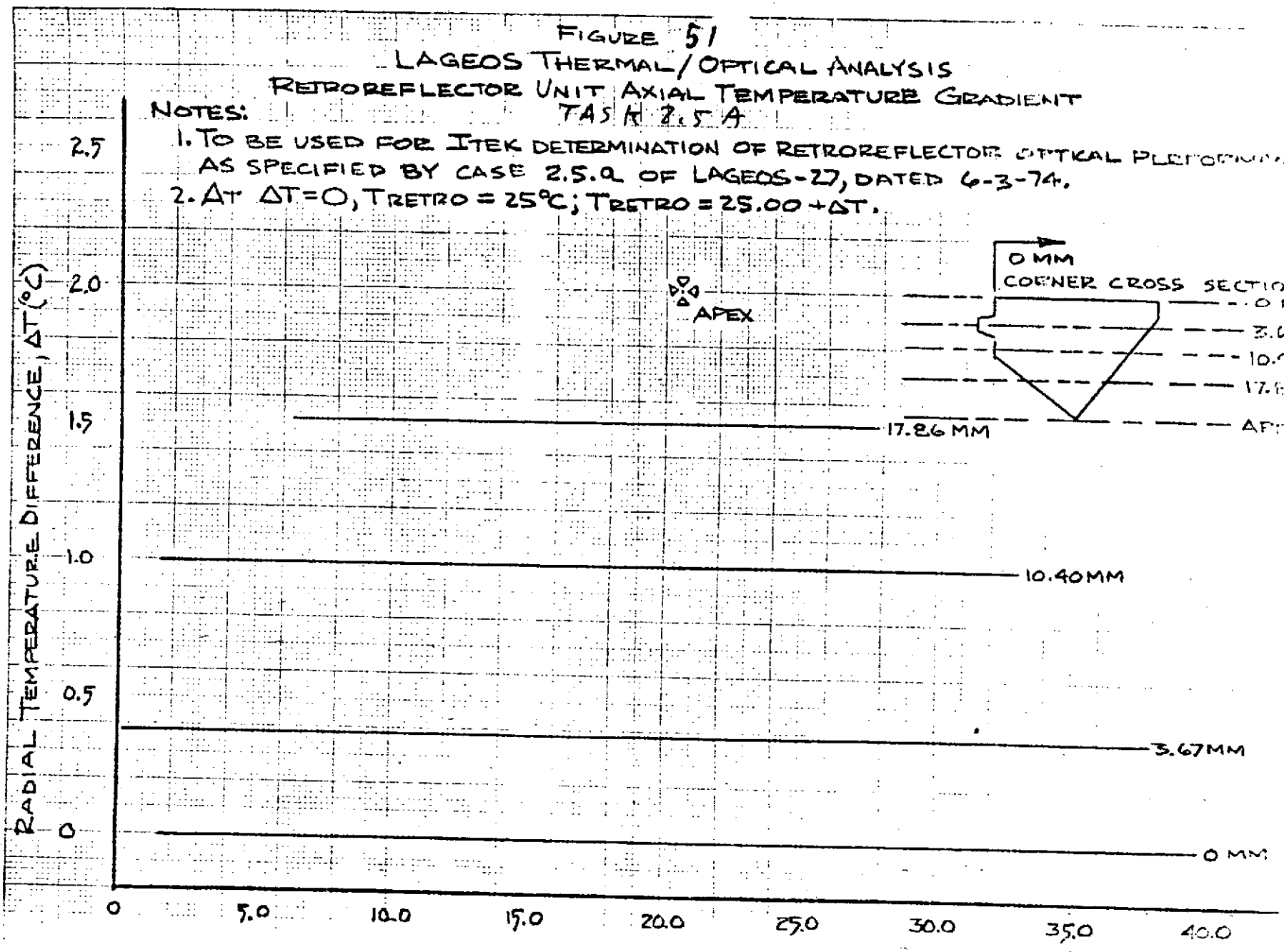


FIGURE 52

LAGEOS THERMAL/OPTICAL ANALYSIS

RETROREFLECTOR UNIT RADIAL TEMPERATURE GRADIENT

T45 FC 2.5 T B

NOTES:

1. TO BE USED FOR ITEK DETERMINATION OF RETROREFLECTOR OPTICAL PERFORMANCE AS SPECIFIED BY CASE 2.5.b OF LAGEOS-27, DATED 6-3-74.
2. AT $\Delta T = 0$, $T_{RETRO} = 25°C$; $T_{RETRO} = 25.00 + \Delta T$.

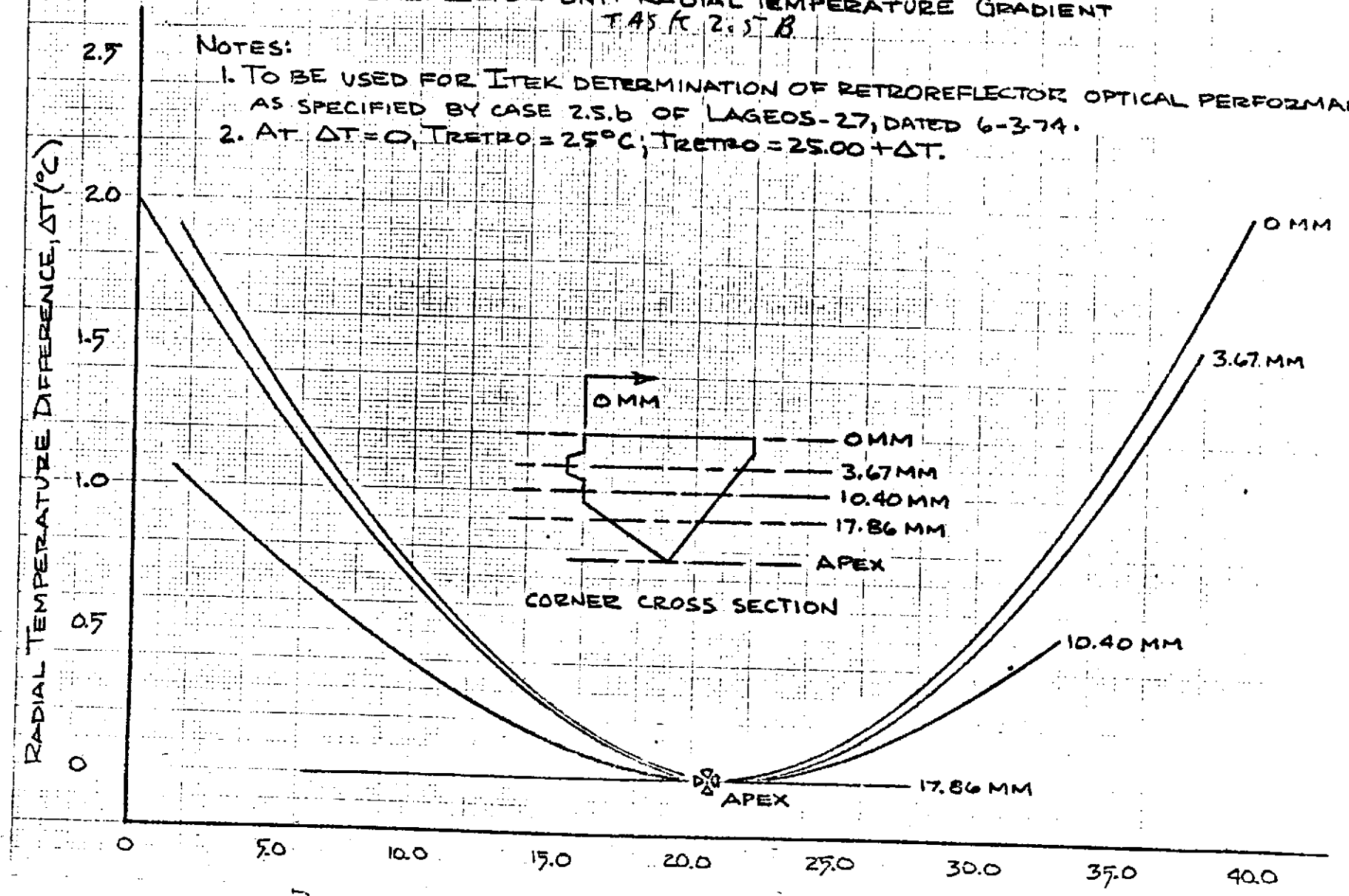
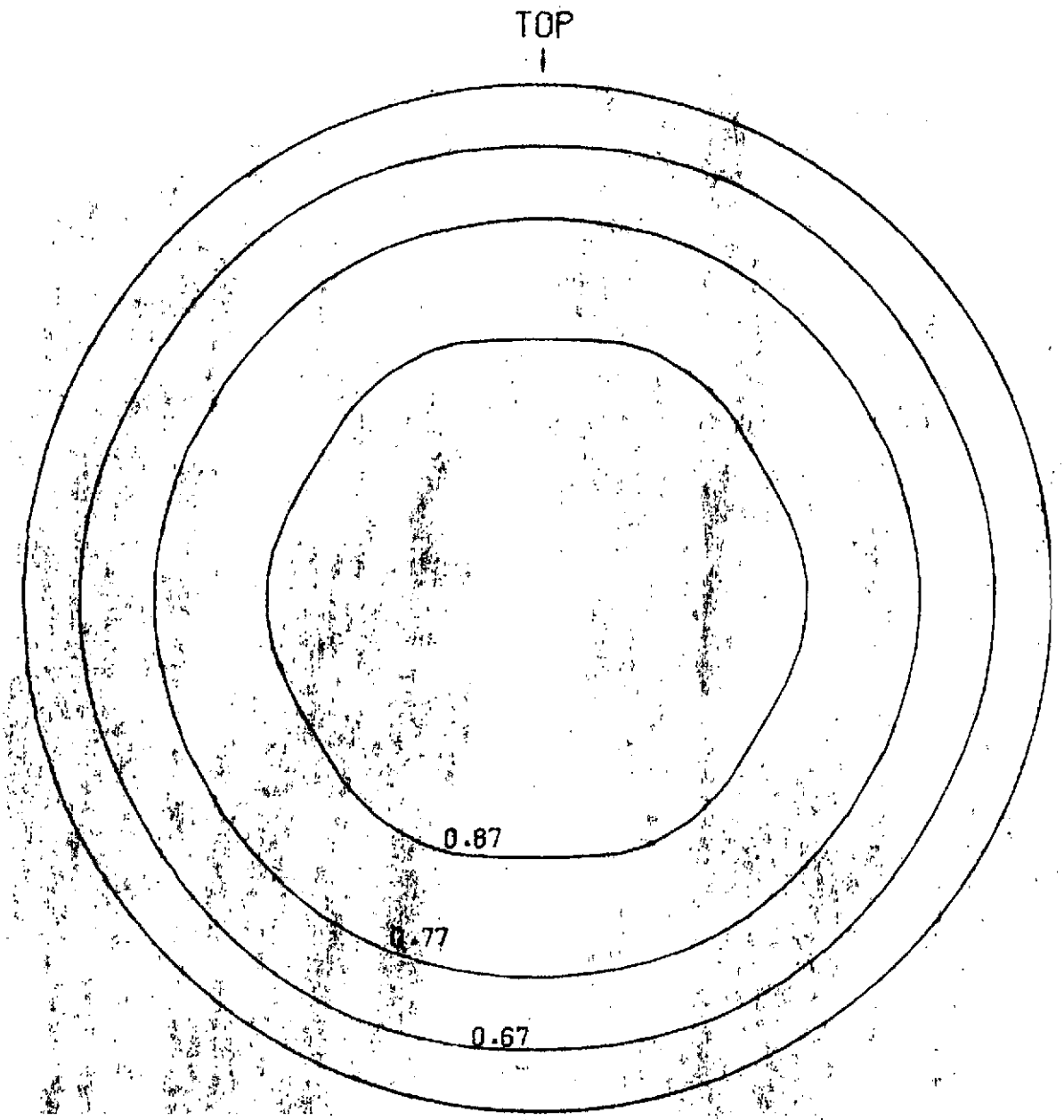


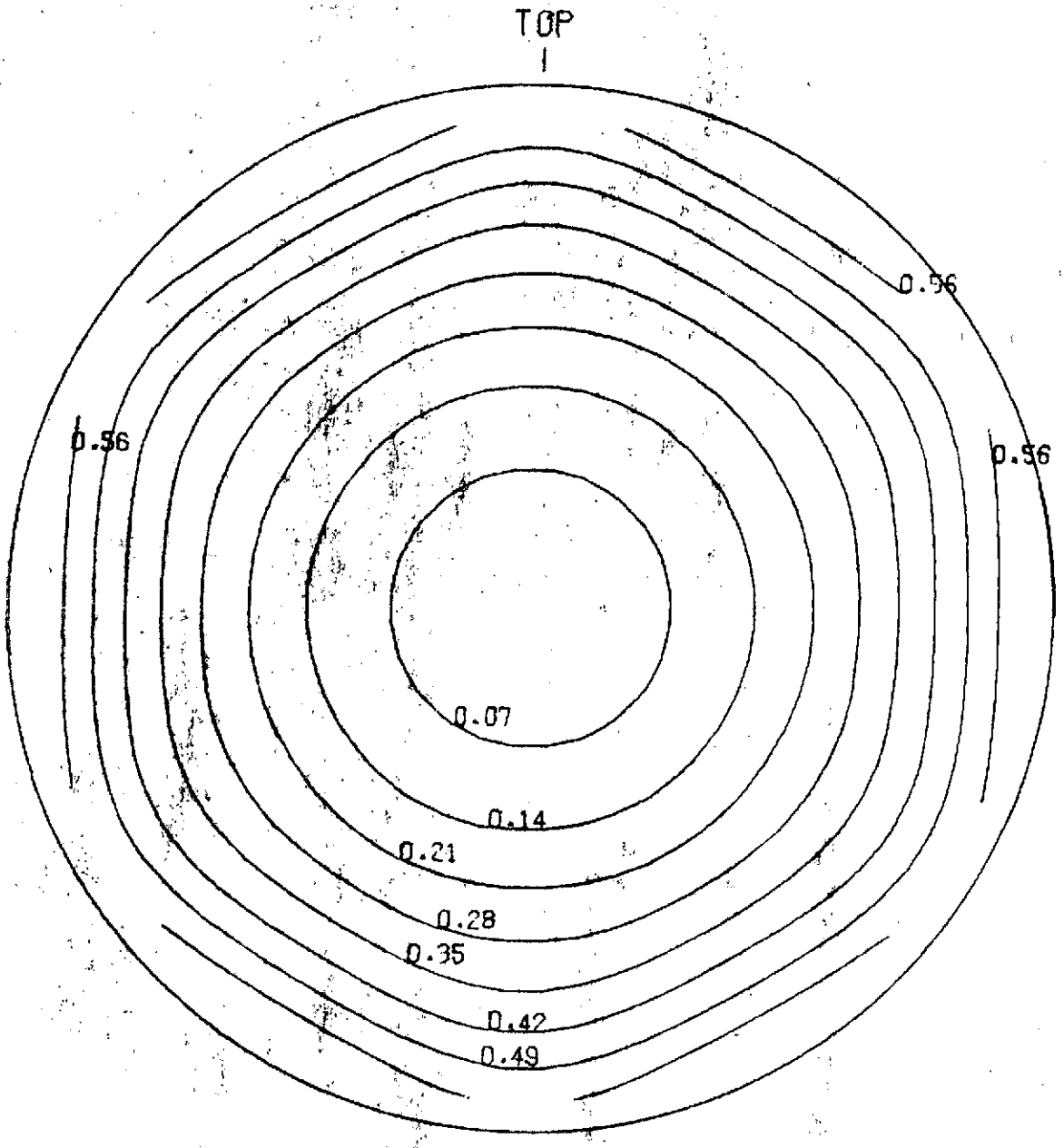
Figure 53

Effect on an Axial Gradient on the Wavefront of a Cube Corner



REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

FIGURE 54
EFFECT OF A RADIAL GRADIENT IN A
WAVEFRONT OF A CUBE CORNER



ENCIRCLED ENERGY

Task 2.3B - Nominal + Mfg. Error + First Temperature On Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.2	0.3	0.3	0.2	0.1	0.1	0.4	0.3	0.3
10.00	1.1	1.2	1.2	0.7	0.4	0.4	1.4	1.4	1.1
15.00	3.4	3.7	3.7	2.1	1.8	1.9	4.0	4.0	3.2
20.00	6.4	6.9	7.0	4.7	4.3	4.7	7.5	7.5	6.4
25.00	10.2	10.9	11.4	10.3	10.7	10.3	11.9	11.9	10.8
30.00	15.8	16.8	16.9	16.4	17.3	16.5	17.9	18.3	17.3
35.00	23.8	25.2	24.6	23.6	24.7	23.6	26.5	26.9	25.5
40.00	31.7	33.3	32.7	32.6	33.1	32.5	35.6	35.4	33.9
45.00	39.6	40.8	41.4	43.4	45.8	43.2	44.1	43.1	41.8
50.00	48.5	48.8	50.0	52.3	54.7	52.1	51.7	50.9	50.4
55.00	57.8	57.2	59.4	60.8	62.6	60.6	60.3	58.5	58.8
60.00	64.9	64.2	66.4	67.2	68.8	67.2	66.9	64.9	65.3
65.00	70.6	69.8	71.9	72.6	74.5	72.6	72.2	70.1	70.8
70.00	75.0	74.3	76.0	76.5	77.7	76.5	76.0	74.3	75.2
75.00	78.8	78.0	79.2	79.4	80.0	79.4	79.1	78.0	78.8
80.00	81.5	80.6	81.4	81.4	81.7	81.5	81.4	80.6	81.4
85.00	83.2	82.5	83.2	83.3	83.4	83.3	83.4	82.6	83.2
90.00	84.6	84.3	84.7	84.9	85.0	84.9	84.9	84.5	84.8
95.00	86.0	86.0	86.1	86.3	86.5	86.3	86.3	86.1	86.2
100.00	87.1	87.4	87.4	87.5	87.9	87.6	87.5	87.3	87.2
105.00	88.1	88.5	88.6	88.6	88.9	88.7	88.6	88.4	88.1
110.00	89.1	89.4	89.5	89.4	89.7	89.5	89.5	89.4	89.2
115.00	90.0	90.2	90.2	90.2	90.3	90.1	90.2	90.2	90.0
120.00	90.7	90.8	90.8	90.8	90.8	90.8	90.9	90.9	90.7
125.00	91.2	91.3	91.3	91.4	91.4	91.3	91.5	91.4	91.3
130.00	91.8	91.8	91.9	91.9	92.0	91.9	92.0	91.9	91.9
135.00	92.3	92.3	92.4	92.4	92.5	92.4	92.3	92.3	92.3
140.00	92.7	92.7	92.8	92.9	92.9	92.9	92.9	92.8	92.8
145.00	93.1	93.1	93.2	93.2	93.2	93.2	93.2	93.2	93.1
150.00	93.5	93.5	93.5	93.6	93.6	93.6	93.5	93.5	93.5
155.00	93.8	93.8	93.9	93.8	93.8	93.8	93.8	93.8	93.8
160.00	94.2	94.2	94.2	94.1	94.1	94.1	94.1	94.1	94.1
165.00	94.5	94.5	94.5	94.4	94.4	94.5	94.4	94.4	94.4
170.00	94.7	94.7	94.8	94.7	94.8	94.7	94.8	94.7	94.7
175.00	95.0	95.0	95.0	95.0	95.1	95.0	95.1	95.0	95.0
180.00	95.3	95.3	95.3	95.3	95.4	95.3	95.4	95.3	95.3
184.99	95.5	95.5	95.5	95.6	95.6	95.6	95.5	95.6	95.6
189.99	95.8	95.8	95.8	95.9	95.8	95.9	95.8	95.8	95.8
194.99	96.0	96.0	96.0	96.0	96.1	96.0	96.0	96.0	96.0
199.99	96.3	96.3	96.2	96.2	96.3	96.3	96.2	96.3	96.3

TABLE 13

ENCIRCLED ENERGY

Task 2.3B - Nominal + Mfg. Error + First Temperature On Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0
4.00	0.2	0.3	0.1	0.1	0.0	0.0	0.1	0.3	0.3
6.00	0.2	0.3	0.5	0.3	0.1	0.1	0.5	0.3	0.3
8.00	0.8	0.9	0.8	0.5	0.1	0.2	0.9	1.0	0.8
10.00	1.1	1.2	1.2	0.7	0.4	0.4	1.4	1.4	1.1
12.00	2.4	2.6	2.0	1.1	0.5	0.8	2.2	2.9	2.3
14.00	2.4	2.6	3.0	2.0	1.2	1.6	3.3	2.9	2.3
16.00	4.0	4.5	4.0	2.4	1.8	2.2	4.4	4.8	3.8
18.00	4.8	5.1	5.1	3.7	4.3	3.4	5.5	5.6	4.7
20.00	6.4	6.9	7.0	4.7	4.3	4.7	7.5	7.5	6.4
22.00	7.2	7.6	8.4	6.8	7.8	6.7	8.9	8.4	7.4
24.00	9.4	10.1	10.2	7.9	9.1	8.0	10.6	10.9	9.9
26.00	10.6	11.2	12.0	10.6	12.6	10.6	12.4	12.3	11.4
28.00	13.7	14.7	15.2	13.5	13.5	13.6	16.2	15.8	14.8
30.00	15.8	16.8	16.9	16.4	17.3	16.5	17.9	18.3	17.3
32.00	20.1	21.4	20.2	18.8	19.0	18.9	21.6	23.0	21.7
34.00	20.9	22.4	22.6	23.0	22.5	23.0	24.5	24.1	22.7
36.00	25.6	27.2	26.2	25.6	25.6	25.6	28.7	28.9	27.4
38.00	27.6	29.4	29.1	29.5	30.7	29.5	31.5	31.4	29.8
40.00	31.7	33.3	32.7	32.6	33.1	32.5	35.6	35.4	33.9
42.00	33.5	35.2	36.3	37.4	39.4	37.3	39.0	37.4	35.8
44.00	38.0	39.3	39.6	39.8	42.1	39.5	42.3	41.5	40.3
46.00	40.9	41.9	43.0	45.1	48.1	44.9	45.5	44.2	43.2
48.00	45.2	45.7	47.5	49.0	49.5	48.6	49.6	48.0	47.3
50.00	48.5	48.8	50.0	52.3	54.7	52.1	51.7	50.9	50.4
52.00	52.8	52.5	54.1	55.8	57.0	55.6	55.5	54.4	54.4
54.00	55.1	54.8	56.8	59.2	60.8	59.0	58.0	56.5	56.4
56.00	59.2	58.6	61.1	62.4	63.1	62.3	61.8	59.9	60.1
58.00	62.0	61.4	63.2	64.6	66.6	64.5	63.9	62.4	62.6
60.00	64.5	64.2	66.4	67.2	68.8	67.2	66.9	64.9	65.3
62.00	66.9	66.1	68.4	69.6	71.4	69.6	69.0	66.7	67.2
64.00	69.8	69.1	70.5	71.2	73.2	71.2	71.0	69.3	70.1
66.00	71.5	71.8	72.6	73.5	75.3	73.5	73.0	71.0	71.7
68.00	73.7	72.9	74.4	74.9	76.1	74.9	74.6	73.1	74.0
70.00	75.0	74.3	76.0	76.5	77.7	76.5	76.0	74.3	75.2
72.00	77.0	76.2	77.3	77.6	78.7	77.6	77.3	76.1	77.1
74.00	77.9	77.1	78.6	78.9	79.6	78.9	78.5	77.1	78.0
76.00	79.5	78.6	79.8	79.9	80.3	79.9	79.6	78.6	79.4
78.00	80.4	79.6	80.5	80.6	81.1	80.6	80.4	79.6	80.3
80.00	81.5	80.6	81.4	81.4	81.7	81.5	81.4	80.6	81.4

RESPONSIBILITY OF THE
ORIGINAL PAGE IS POOR

FIGURE 55

Wavefront Map-(Polarization

Task 2.3B - Nominal + Mfg. Error + First Temperature On Axis

MAP IN UNITS OF 0.01 WAVES

157 151 145 141 138 150 153 153 154 157

172 165 158 151 146 141 136 132 149 151 152 152 155 162 170 178

171 164 158 151 145 141 137 133 128 143 146 147 148 152 158 166 172 176

167 163 156 150 144 139 136 133 130 125 133 138 140 142 147 152 158 163 165 166

161 159 154 148 142 136 133 131 130 127 123 123 128 132 136 140 146 150 153 154 155 159

151 152 149 144 137 131 127 126 126 126 124 119 113 119 124 130 135 140 143 144 145 145 147 149

141 142 143 140 134 127 122 119 120 121 121 119 115 106 112 118 125 130 135 137 138 138 139 141 143 147

201 139 135 134 131 124 117 112 112 114 116 116 114 109 100 105 112 119 125 129 132 132 132 133 135 138 142 220

201 198 195 128 123 115 108 104 104 108 111 111 108 103 94 99 105 111 117 121 124 125 126 128 129 207 215 220

204 200 156 191 117 108 101 96 97 101 105 105 102 96 89 93 96 101 105 109 114 117 120 122 198 207 215 221

214 208 202 196 189 183 177 94 90 90 94 97 98 94 85 84 86 87 90 93 98 103 109 179 188 197 207 216 223 227

218 211 203 195 187 181 176 170 164 83 85 88 88 86 81 77 78 79 79 82 87 166 172 180 188 197 207 217 225 230

223 215 204 194 185 179 175 171 165 160 156 78 79 77 74 70 71 70 70 160 164 170 175 182 188 196 205 215 225 233

228 218 206 195 185 179 176 173 168 163 159 157 70 70 68 62 63 62 156 163 168 173 178 183 188 194 202 213 225 234

231 221 209 197 187 182 179 175 171 166 162 158 152 144 62 53 139 149 157 163 168 173 178 182 185 191 200 211 224 233

233 224 211 200 191 185 182 178 173 168 163 157 149 139 53 62 144 152 158 162 166 171 175 179 182 187 197 209 221 231

234 225 213 202 194 188 183 178 173 168 163 156 62 63 62 68 70 70 157 159 163 168 173 176 179 185 195 206 218 228

233 225 215 205 196 188 182 175 170 164 160 73 73 71 70 74 77 79 78 156 160 165 171 175 179 185 194 204 215 223

230 225 217 207 197 188 180 172 166 87 82 79 79 78 77 81 86 88 88 85 83 164 170 176 181 187 195 203 211 218

227 223 216 207 197 188 179 169 103 98 93 90 87 86 84 89 94 98 97 94 90 90 94 177 183 189 196 202 208 214

221 215 207 198 122 120 117 114 109 105 101 96 93 89 96 102 105 105 101 97 96 101 108 117 191 196 200 204

220 215 207 129 128 126 125 124 121 117 111 105 99 94 103 108 111 111 108 104 104 108 115 123 128 195 198 201

220 142 138 135 133 132 132 132 129 125 119 112 105 100 109 114 116 116 114 112 112 117 124 131 134 135 135 201

147 143 141 139 138 138 137 135 130 125 118 112 106 115 119 121 121 120 119 122 127 134 140 143 142 141

149 147 145 145 144 143 140 135 130 124 119 113 119 124 126 126 126 127 131 137 144 149 152 151

155 155 154 153 150 146 140 136 132 128 123 123 127 130 131 133 136 141 148 154 159 161

160 165 163 158 152 147 142 140 138 133 125 130 133 136 139 144 150 156 163 167

176 172 166 156 152 148 147 146 143 128 133 137 141 145 151 158 164 171

178 170 162 155 152 152 151 149 132 136 141 146 151 158 165 172

157 154 153 153 150 138 141 145 151 157

FIGURE 56

Wavefront Plot-Q Polarization

Task 2.3B - Nominal + Mfg. Error + First Temperature On Axis

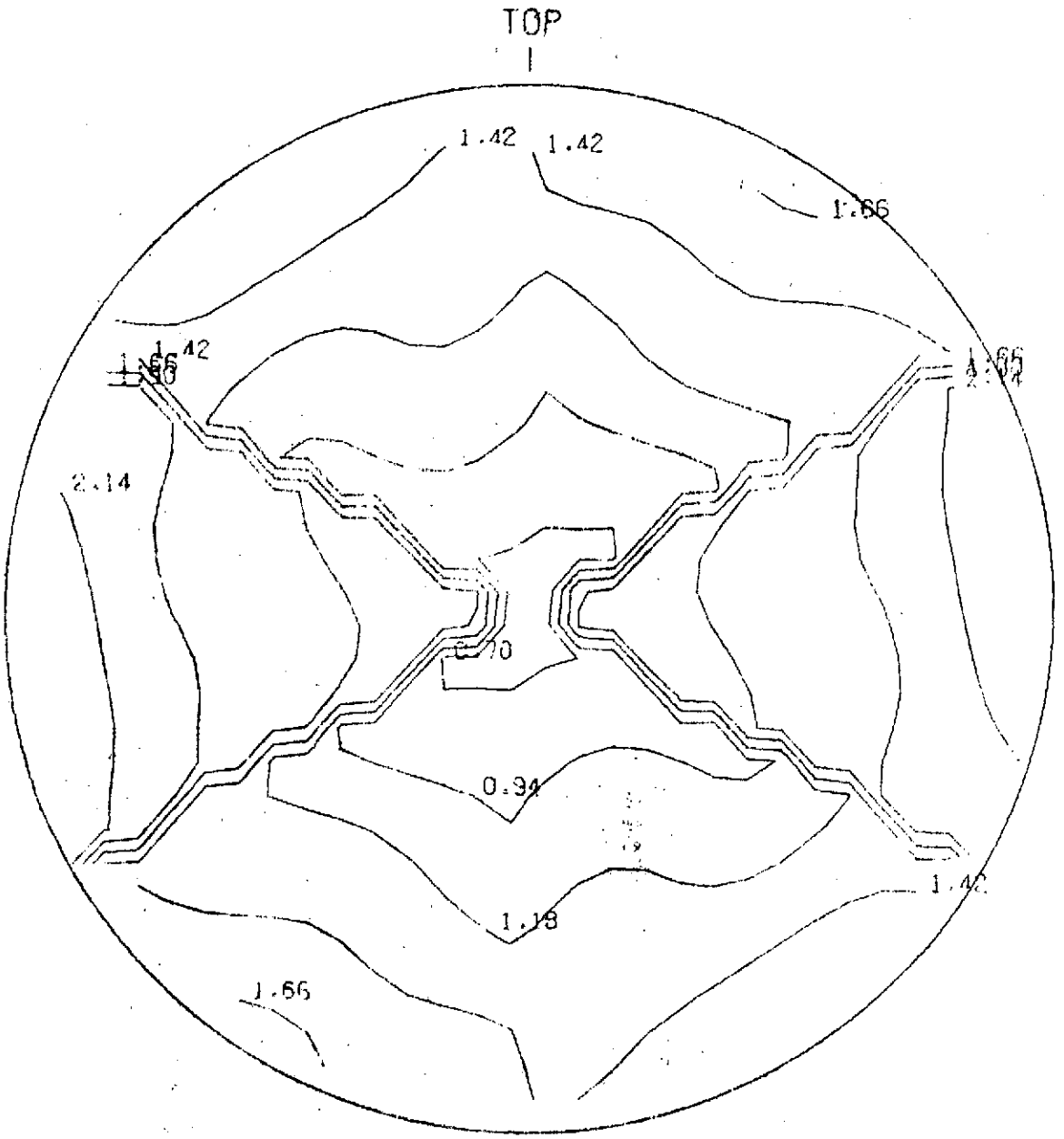


FIGURE 57

Wavefront Map-P Polarization

Task 2.3B - Nominal + Mfg. Error + First Temperature On Axis

MAP IN UNITS OF 0.01 WAVES

```
                                        215 209 204 200 196 159 161 162 162 165
                                231 223 216 209 204 199 195 191 157 160 160 161 164 170 178 186
                            229 223 218 210 204 199 195 191 187 151 154 155 157 160 167 174 180 185
                        226 221 215 208 202 158 195 192 188 184 142 146 149 151 155 161 167 171 174 175
                    219 217 212 206 200 194 191 190 188 185 181 131 137 141 144 149 154 159 161 162 163 164
                209 210 208 203 156 190 186 185 185 184 182 178 122 128 133 138 143 148 152 153 153 154 155 157
            203 201 201 198 193 186 180 178 178 180 180 178 173 114 120 127 133 139 143 146 146 146 147 149 152 155
        213 194 164 193 189 183 176 171 170 172 175 175 172 168 108 114 120 127 133 138 140 140 141 142 143 146 150 186
    217 214 211 186 181 174 167 163 163 166 170 170 167 162 103 108 113 120 125 129 132 134 135 136 138 173 181 186
220 216 212 207 175 167 159 158 156 160 163 163 160 155  98 101 105 109 114 118 122 125 128 131 164 173 181 187
230 224 218 212 206 199 193 153 148 149 152 155 156 153 147  92  94  96  98 101 106 112 117 145 154 163 173 182 189 193
234 227 219 211 203 197 192 186 180 142 144 146 147 145 140  86  87  87  88  90  95 132 138 146 154 163 173 183 191 196
239 231 220 210 201 195 191 187 181 176 172 137 137 136 133  79  79  79  79 126 131 136 141 148 156 162 171 181 191 199
244 234 222 211 201 195 192 189 184 179 175 173 129 128 126  70  71  71 122 129 134 139 144 149 154 160 168 179 191 200
247 237 225 213 203 198 195 191 187 182 178 174 168 160 120  61 105 115 123 129 134 139 144 148 151 157 166 177 190 199
249 240 227 216 207 201 198 194 189 184 179 173 165 155  73 132 110 118 124 128 132 137 141 145 148 153 163 175 187 197
253 241 229 218 210 204 199 194 189 184 179 172  82  83  82 138 140 141 123 125 129 134 139 142 145 151 161 172 184 194
249 241 231 221 212 204 198 191 186 180 176  90  90  91  90 144 147 149 148 122 126 131 137 141 145 151 160 170 181 189
246 241 233 223 213 204 196 188 182 107 102  99  99  98  97 151 156 159 158 156 154 130 136 142 147 153 161 169 177 184
243 239 232 223 213 204 195 129 123 118 113 110 108 106 104 159 165 168 167 164 161 160 164 143 149 155 162 168 174 180
    237 231 223 214 142 140 137 134 130 125 121 116 113 109 167 172 175 175 171 168 167 171 178 187 157 162 166 170
    236 231 223 149 148 146 145 144 141 137 131 125 119 114 173 178 181 181 178 175 174 178 185 193 198 161 164 167
    236 162 158 155 153 152 152 152 149 145 139 132 125 120 180 184 187 186 184 182 183 187 194 201 205 206 205 167
        167 163 161 159 158 158 157 155 151 145 138 132 126 185 189 192 192 190 189 192 197 204 210 213 213 211
            169 167 165 165 164 163 160 155 150 145 139 134 189 194 196 196 196 197 202 208 214 220 222 221
                176 175 174 173 170 166 160 156 152 148 143 193 197 200 201 203 206 211 218 224 229 231
                    186 185 183 178 173 167 162 160 156 153 196 200 203 206 209 214 220 227 233 238
                        196 192 186 178 172 168 167 166 163 158 203 207 211 216 221 228 235 241
                            158 193 182 175 172 172 171 169 202 207 211 216 221 228 235 242
                                177 174 173 173 171 208 212 216 221 227
```

FIGURE 58

Wavefront Plot-P Polarization

Task 2.3B - Nominal + Mfg. Error + First Temperature On Axis

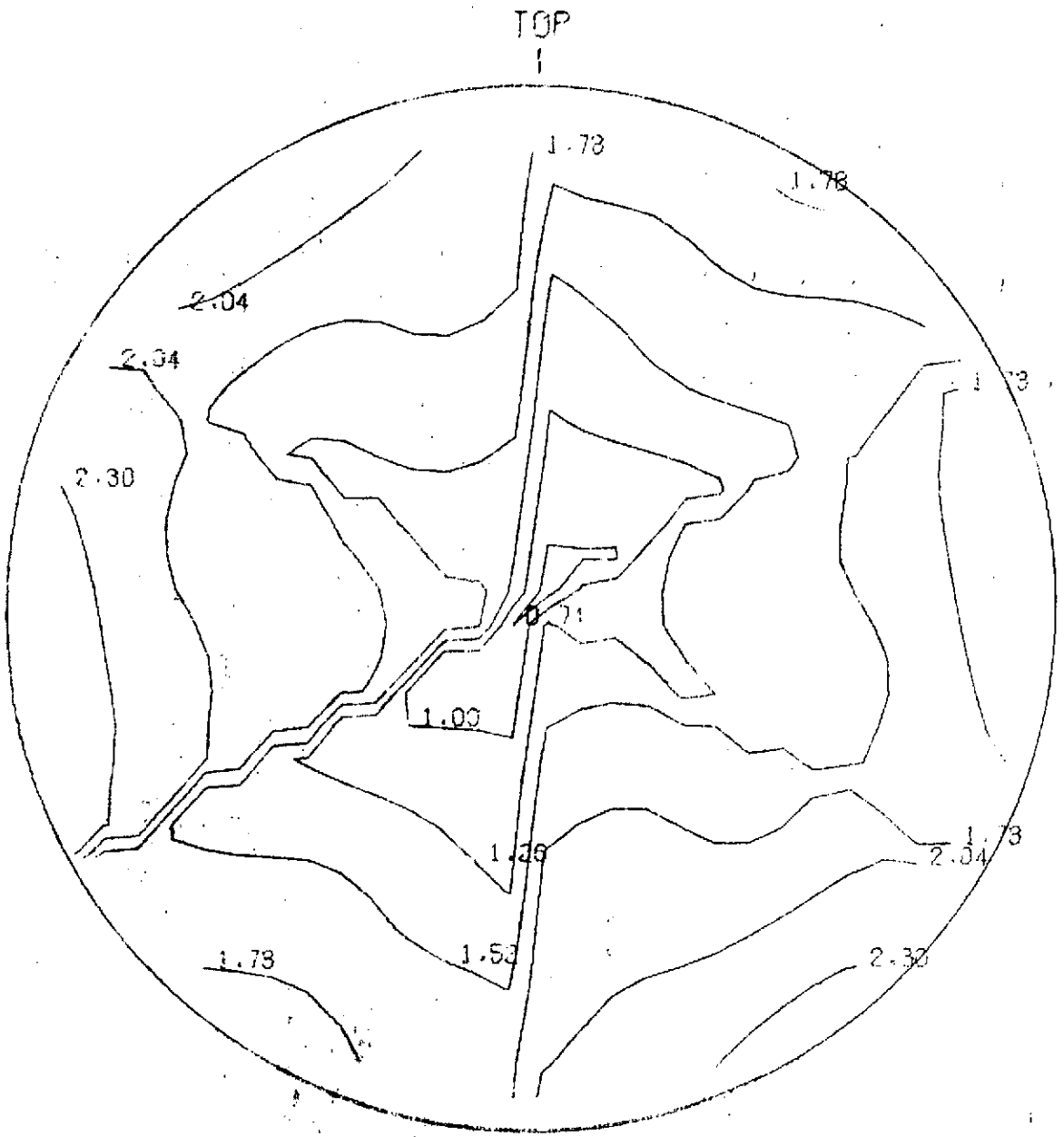


FIGURE 59

Task 2.3B - Nominal + Mfg. Error + First Temperature On Axis

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0264 = 100
TOTAL ENERGY = 0.2461CCOD+01
MAP REPRESENTS 0.2315657D+01 OR 94.3941 PERCENT OF TOTAL ENERGY

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FIGURE 60

Point Spread Function

Task 2.3B - Nominal + Mfg. Error + First Temperature On Axis

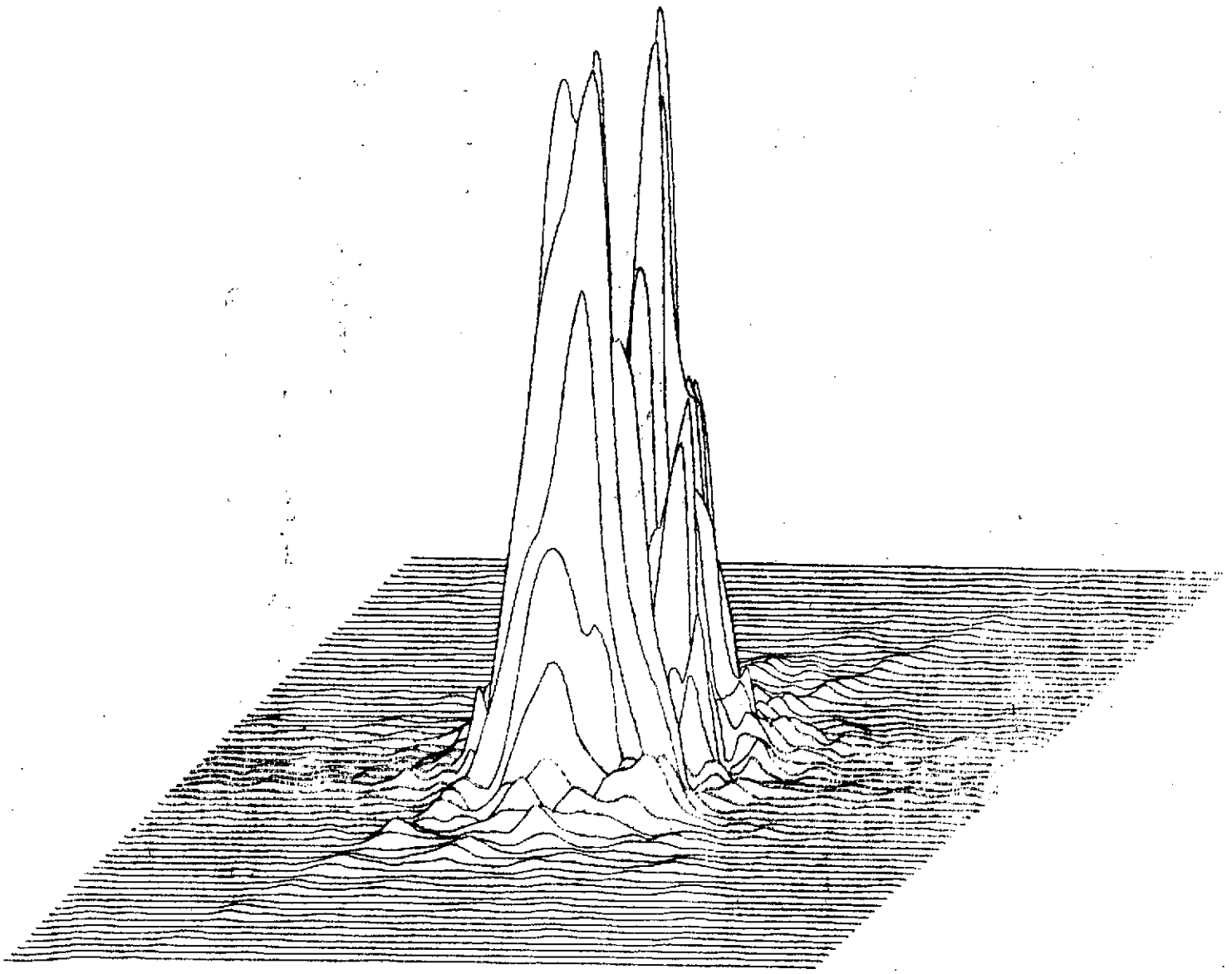

FIGURE 61

Intensity Distriubtion - Central 129 Microradians

Task 2.3B - Nominal + Mfg. Error + First Temperature On Axis

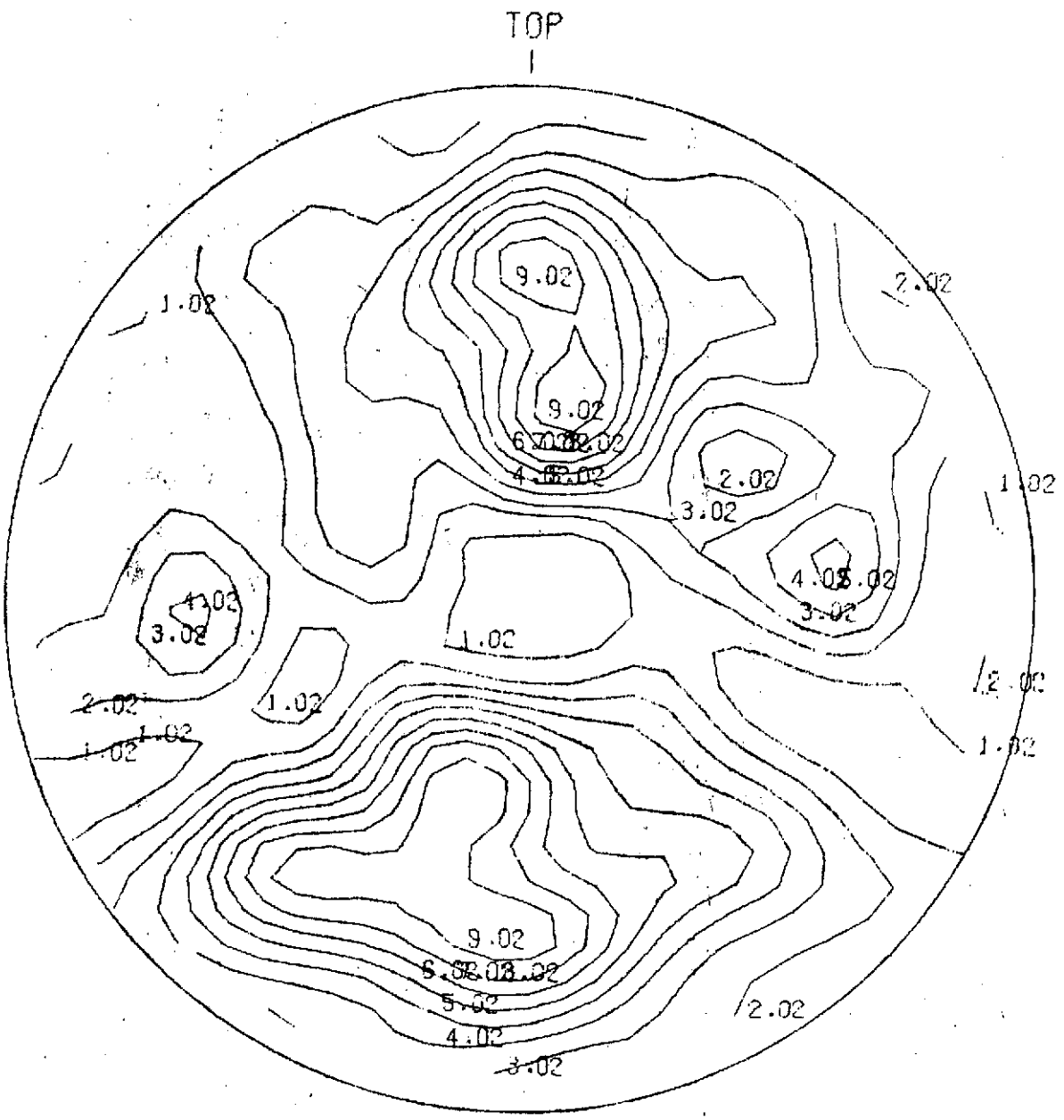

FIGURE 62

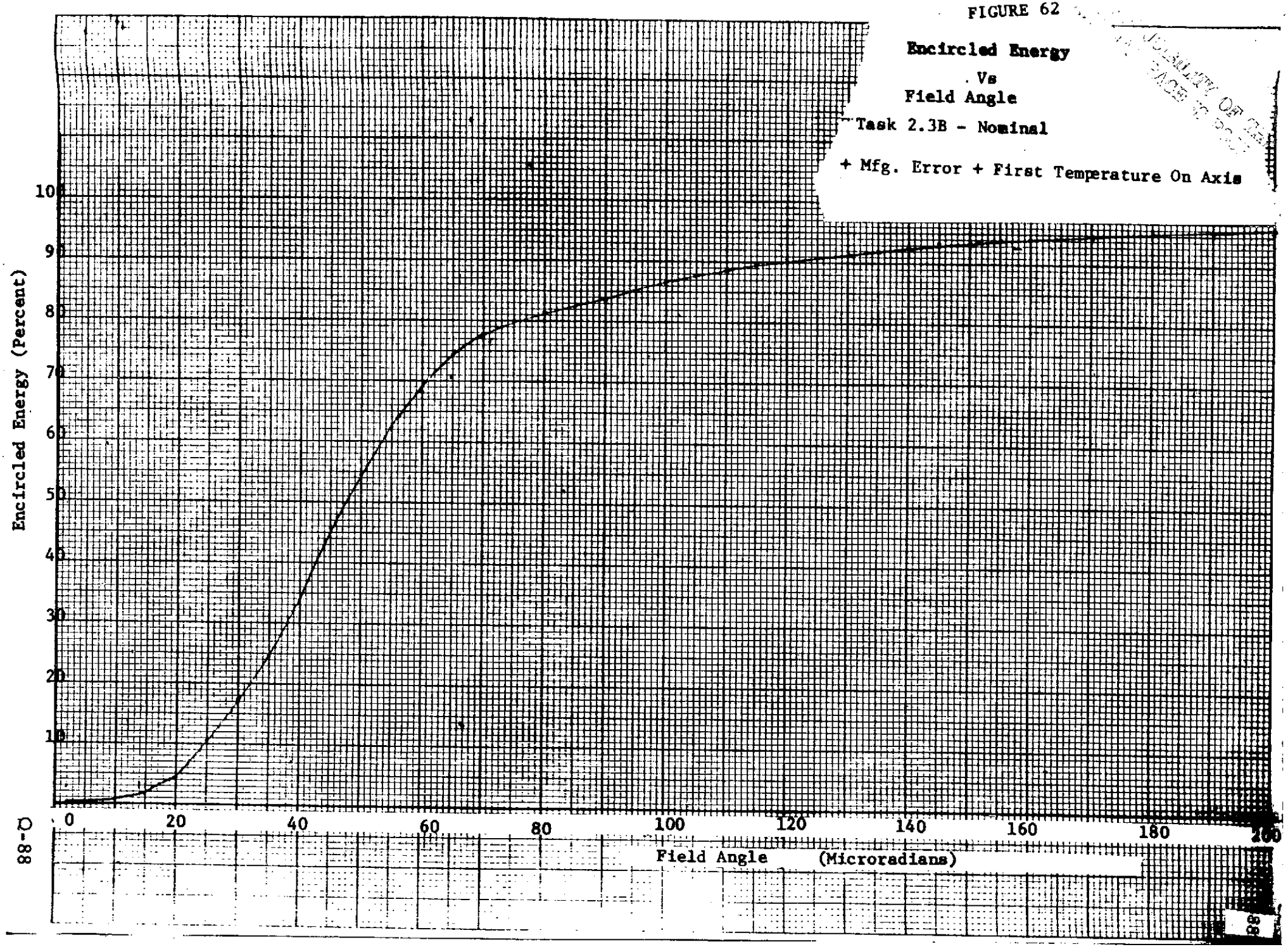
Encircled Energy
Vs
Field Angle
Task 2.3B - Nominal
+ Mfg. Error + First Temperature On Axis
Encircled Energy (Percent)
10
90
80
70
60
50
40
30
20
10
0
20
40
60
80
100
120
140
160
180
200
Field Angle (Microradians)

TABLE 14

ENCIRCLED ENERGY

Task 2.3B - Nominal + Mfg. Error + First Temperature -15° Off Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0
4.00	0.3	0.3	0.2	0.2	0.1	0.2	0.2	0.4	0.4
6.00	0.3	0.3	0.4	0.6	1.1	0.6	0.5	0.4	0.4
8.00	0.9	1.0	0.8	1.2	1.1	1.2	0.9	1.2	1.2
10.00	1.3	1.4	1.1	1.7	2.1	1.6	1.2	1.7	1.6
12.00	3.0	3.1	1.8	2.9	2.4	2.8	2.0	3.7	3.5
14.00	3.0	3.1	2.7	4.1	3.2	4.1	3.3	3.7	3.5
16.00	5.1	5.3	3.5	5.5	3.9	5.4	4.2	6.2	5.9
18.00	6.0	6.2	4.8	6.7	5.9	6.7	5.7	7.2	6.9
20.00	7.8	8.0	6.3	8.7	5.9	8.7	7.5	9.4	9.0
22.00	8.7	8.9	8.5	10.3	9.0	10.3	10.0	10.5	10.1
24.00	10.9	11.0	9.7	11.6	10.9	11.5	11.3	13.0	12.6
26.00	12.0	12.1	12.6	13.6	14.6	13.5	14.4	14.4	13.9
28.00	14.5	14.5	15.3	16.2	15.8	16.0	17.6	17.2	16.7
30.00	16.6	16.5	17.9	18.3	19.7	18.0	20.3	19.5	19.1
32.00	20.4	20.3	19.9	20.7	22.2	20.4	22.5	23.1	22.8
34.00	21.2	21.0	23.0	23.8	24.5	23.5	25.9	24.0	23.8
36.00	25.7	25.4	25.5	27.0	28.1	26.7	28.4	28.0	27.9
38.00	28.0	27.8	28.3	30.1	31.2	29.7	31.0	30.4	30.3
40.00	31.8	31.5	31.2	33.6	33.2	33.4	33.9	33.7	33.8
42.00	33.9	33.6	35.0	37.3	36.6	37.2	37.4	35.7	35.9
44.00	37.9	37.7	36.9	39.4	39.7	39.4	39.3	39.5	39.7
46.00	40.7	40.5	41.2	43.1	43.6	43.2	43.4	42.5	42.8
48.00	43.8	43.7	44.5	46.4	45.4	46.5	47.0	45.6	45.8
50.00	46.9	46.8	47.7	48.7	49.9	48.9	49.6	48.9	49.1
52.00	49.9	50.0	50.5	51.5	53.2	51.7	52.9	52.1	52.2
54.00	51.7	51.8	54.3	54.5	56.6	54.6	56.1	54.1	54.3
56.00	55.1	55.3	57.4	58.0	59.9	58.1	59.7	57.4	57.5
58.00	57.8	58.0	59.7	60.3	63.2	60.4	61.7	60.2	60.3
60.00	60.4	60.6	62.6	63.4	65.9	63.4	64.8	62.6	62.7
62.00	62.5	62.7	65.3	66.0	68.1	66.0	67.3	64.7	64.9
64.00	66.0	66.0	67.0	68.0	70.3	68.0	69.3	67.5	67.8
66.00	68.1	68.1	69.9	70.5	72.5	70.6	71.8	69.6	70.0
68.00	70.5	70.4	71.9	72.4	73.4	72.6	73.4	71.5	72.0
70.00	72.4	72.3	73.9	74.1	75.4	74.3	75.1	73.1	73.7
72.00	74.6	74.4	75.4	75.4	77.0	75.7	76.3	74.9	75.4
74.00	75.6	75.4	77.2	77.1	78.4	77.3	77.7	76.0	76.5
76.00	77.6	77.4	78.7	78.4	79.5	78.6	78.8	77.5	77.9
78.00	78.8	78.7	79.6	79.4	80.7	79.6	79.6	78.7	79.0
80.00	80.0	79.9	81.0	80.6	81.6	80.7	80.7	79.8	80.0

TABLE 15

ENCIRCLED ENERGY

Task 2.3B - Nominal + Mfg. Error + First Temperature -15° Off Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS):									
X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.3	0.3	0.4	0.5	0.7	0.5	0.4	0.4	0.4
10.00	1.3	1.4	1.1	1.7	2.1	1.6	1.2	1.7	1.6
15.00	4.3	4.4	3.1	5.0	3.9	4.9	3.7	5.2	4.9
20.00	7.8	8.0	6.3	8.7	5.9	8.7	7.5	9.4	9.0
25.00	11.6	11.7	12.2	13.2	12.1	13.1	14.1	13.9	13.4
30.00	16.6	16.5	17.9	18.3	19.7	18.0	20.3	19.5	19.1
35.00	24.0	23.8	23.8	25.1	27.2	24.7	26.4	26.3	26.1
40.00	31.8	31.5	31.2	33.6	33.2	33.4	33.9	33.7	33.8
45.00	39.3	39.0	39.7	41.6	41.2	41.7	41.8	41.0	41.2
50.00	46.9	46.8	47.7	48.7	49.9	48.9	49.6	48.9	49.1
55.00	54.0	54.1	55.4	56.1	59.2	56.2	57.6	56.2	56.2
60.00	60.4	60.6	62.6	63.4	65.9	63.4	64.8	62.6	62.7
65.00	66.8	66.8	69.0	69.7	71.4	69.7	70.9	68.4	68.7
70.00	72.4	72.3	73.9	74.1	75.4	74.3	75.1	73.1	73.7
75.00	76.9	76.7	77.8	77.7	79.1	77.9	78.3	76.9	77.3
80.00	80.0	79.9	81.0	80.6	81.6	80.7	80.7	79.8	80.0
85.00	82.2	82.3	83.2	82.9	83.6	82.9	82.8	82.2	82.1
90.00	84.0	84.1	84.6	84.6	84.9	84.5	84.4	84.1	83.9
95.00	85.5	85.6	85.7	85.8	86.0	85.7	85.8	85.7	85.5
100.00	86.6	86.6	86.7	86.8	86.9	86.8	86.9	86.8	86.7
105.00	87.5	87.5	87.7	87.7	87.8	87.7	87.8	87.6	87.6
110.00	88.3	88.4	88.5	88.5	88.7	88.6	88.6	88.4	88.5
115.00	89.2	89.2	89.3	89.2	89.4	89.3	89.3	89.1	89.3
120.00	89.9	89.9	90.0	89.9	90.1	90.0	89.9	89.8	89.9
125.00	**90.5**	**90.5**	**90.6**	**90.6**	**90.7**	**90.6**	**90.5**	**90.4**	**90.4**
130.00	**91.0**	**91.0**	**91.1**	**91.1**	**91.2**	**91.1**	**91.0**	**90.9**	**90.9**
135.00	**91.5**	**91.4**	**91.5**	**91.5**	**91.5**	**91.5**	**91.6**	**91.5**	**91.5**
140.00	**91.9**	**91.9**	**91.9**	**91.9**	**91.9**	**91.9**	**91.9**	**91.9**	**91.9**
145.00	**92.3**	**92.3**	**92.3**	**92.3**	**92.2**	**92.3**	**92.3**	**92.3**	**92.2**
150.00	**92.7**	**92.7**	**92.7**	**92.7**	**92.7**	**92.7**	**92.6**	**92.7**	**92.6**
155.00	**93.0**	**93.1**	**93.1**	**93.1**	**93.1**	**93.0**	**93.1**	**93.0**	**93.0**
160.00	**93.4**	**93.4**	**93.4**	**93.4**	**93.4**	**93.4**	**93.4**	**93.5**	**93.4**
165.00	**93.8**	**93.7**	**93.8**	**93.8**	**93.8**	**93.8**	**93.8**	**93.8**	**93.8**
170.00	**94.1**	**94.0**	**94.1**	**94.2**	**94.2**	**94.2**	**94.1**	**94.1**	**94.1**
175.00	**94.4**	**94.4**	**94.4**	**94.4**	**94.5**	**94.4**	**94.4**	**94.4**	**94.5**
180.00	**94.7**	**94.7**	**94.7**	**94.7**	**94.8**	**94.7**	**94.8**	**94.7**	**94.7**
184.99	**95.0**	**95.0**	**95.0**	**95.0**	**94.9**	**95.0**	**95.0**	**95.0**	**95.0**
189.99	**95.3**	**95.3**	**95.3**	**95.3**	**95.3**	**95.3**	**95.3**	**95.3**	**95.2**
194.99	**95.5**	**95.5**	**95.6**	**95.5**	**95.6**	**95.5**	**95.5**	**95.5**	**95.4**
199.99	**95.8**	**95.8**	**95.8**	**95.8**	**95.8**	**95.8**	**95.8**	**95.8**	**95.7**

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FIGURE 63

Wavefront Map-() Polarization

Task 2.3B - Nominal + Mfg. Error + First Temperature -35° Off Axis

MAP IN UNITS OF 0.01 WAVES

```
                                                193 186 192 196
                                        228 218 208 198 189 183 189 193 198 203 208 213
                                    239 232 224 214 204 195 187 181 187 191 197 202 207 213 218 223
                                236 231 225 218 209 199 191 183 178 183 188 193 199 205 211 216 222 227
                            229 228 226 223 217 210 202 193 185 178 173 179 183 188 194 200 206 212 218 223 229 234
                        218 219 218 217 214 209 203 196 187 180 173 168 173 178 183 188 194 200 206 212 217 223 229 234
                        211 211 211 210 207 203 197 190 182 175 169 164 168 172 177 182 187 193 199 205 211 217 223 225
                    202 198 193 206 205 202 197 192 185 178 172 165 160 163 167 171 176 181 187 192 199 205 211 200 209 216
                210 206 202 197 192 186 197 193 188 181 175 168 162 156 159 162 166 170 175 180 186 192 184 192 201 208 216 222
                214 210 205 201 195 189 182 174 166 178 172 165 159 153 154 157 161 165 170 158 167 176 185 194 201 209 215 221
            221 217 213 209 203 197 190 182 174 166 158 151 162 155 149 150 152 156 144 152 160 169 178 187 195 203 209 215 220 226
        223 219 214 209 204 197 190 181 173 164 156 149 141 135 144 144 133 140 147 155 163 171 180 189 197 204 210 215 220 224
    225 220 215 210 203 196 188 179 170 162 154 146 138 150 147 147 153 143 150 157 165 173 182 190 198 204 209 214 218 222
            221 215 209 202 195 186 177 168 159 151 162 158 155 152 151 157 163 170 159 166 174 182 190 197 202 207 211 215
            222 215 208 201 193 184 175 166 177 172 168 163 160 156 155 160 167 173 180 185 173 181 188 194 199 204 208 212
                216 208 200 192 201 195 189 183 178 173 168 164 161 158 163 170 176 183 189 195 199 202 191 195 200 204
            217 209 219 219 207 201 195 190 184 179 174 169 165 162 167 173 180 187 194 200 204 207 208 208 196 201
                231 225 219 214 208 202 196 190 185 179 175 170 166 171 177 184 192 199 206 210 213 214 214 214
                    231 226 220 214 209 203 197 191 185 180 176 171 176 182 190 198 206 213 218 221 223 223
                        231 225 220 214 208 202 197 191 186 181 175 181 188 196 205 214 221 227 230 232
                        228 223 217 212 206 201 195 190 185 179 185 193 202 211 221 229 235 240
                            218 213 208 203 197 192 188 182 188 196 206 216 226 235
                                208 203 199 194 190 184 190 199 209 220
```

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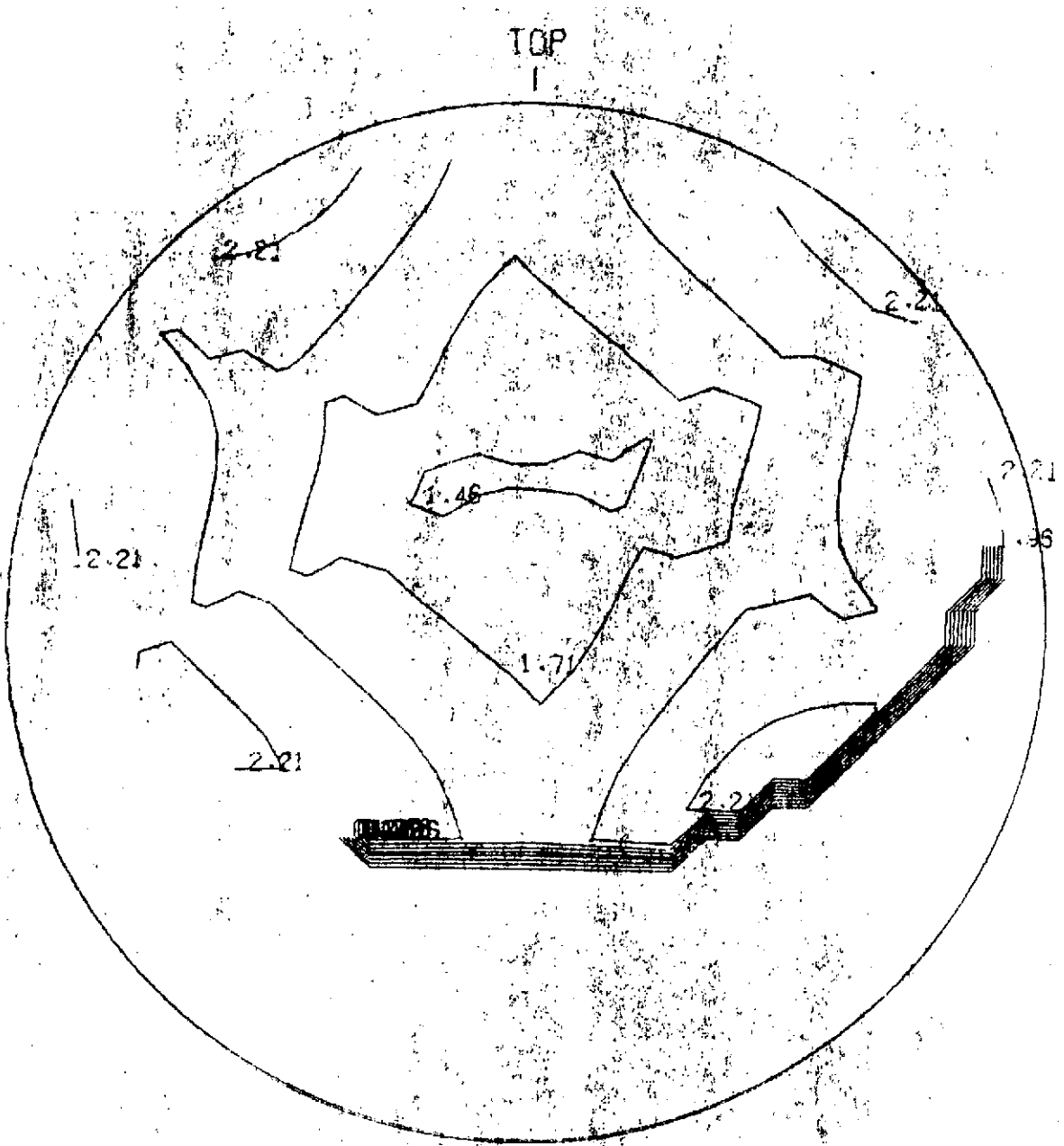
16-0

FIGURE 64

Wavefront Plot-Q Polarization

Task 2.3B - Nominal + Mfg. Error + First Temperature -15° Off Axis



DISCONTINUITY OF THE
ORIGINAL PAGE IS POOR.

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FIGURE 65

Wavefront Map-P Polarization

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Task 2.3B - Nominal + Mfg. Error + First Temperature -15° Off Axis

MAP IN UNITS OF 0.01 WAVES

```
                                                  162 156 112 116
                                          198 188 177 168 159 152 109 113 118 123 127 132
                                      209 202 193 184 174 164 156 150 106 111 116 121 127 132 138 143
                                  205 201 195 187 178 169 160 153 147 103 108 113 119 124 130 136 141 147
                              198 197 196 192 187 180 171 163 155 148 143  98 103 108 114 120 126 131 137 143 148 154
                          188 188 188 187 184 179 172 165 157 149 143 138  93  97 102 108 114 119 125 131 137 142 148 154
                          180 181 180 179 177 172 166 159 152 145 138 133  88  92  96 101 107 113 119 125 130 136 142 148
                      219 214 210 175 174 171 167 161 155 148 141 135 129  83  87  91  96 101 106 112 118 124 130 167 176 183
                  227 223 218 214 209 203 167 162 157 151 144 138 132 126  78  82  86  90  95 100 106 112 150 155 167 175 182 189
                  230 226 222 217 212 205 158 191 183 147 141 135 128 122  74  77  81  85  89 125 133 143 152 161 168 176 182 188
              298 293 229 225 220 214 207 159 191 183 175 169 131 125 119  69  72  75 111 119 127 136 145 154 162 170 176 182 187 193
          240 235 231 226 221 214 206 198 189 181 173 165 158 151 114  64 100 107 114 122 130 138 147 156 164 171 177 182 187 191
          241 237 232 226 220 213 205 196 187 178 170 162 155  79  76 126 132 110 117 124 132 140 149 157 164 171 176 181 185 189
      237 232 226 219 211 209 193 184 176 167  91  87  84  81 130 136 142 149 126 133 141 145 157 164 165 174 178 182
      238 232 225 218 210 201 192 182 106 101  96  92  88  85 133 139 146 152 159 164 140 148 155 161 166 171 175 179
  232 225 217 209 130 124 118 112 106 102  97  93  89 137 142 149 155 162 168 174 178 181 157 162 167 171
  233 226 148 142 136 130 124 118 113 107 103  98  94 141 146 152 159 166 173 179 183 186 187 187 163 167
      160 154 148 143 137 131 125 119 114 108 104  99 145 150 156 163 171 178 185 189 192 193 193 193
          160 155 149 143 138 132 126 120 114 109 105 150 154 161 169 177 185 192 197 200 201 202
              160 154 149 143 137 131 126 120 115 110 154 159 167 175 184 192 200 205 209 211
              157 152 146 141 135 130 124 119 114 158 164 172 181 190 199 208 214 219
                  147 142 137 131 126 121 117 161 167 175 185 195 205 214
                      137 132 128 123 119 163 169 178 188 199
```

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FIGURE 66

Wavefront Plot-P Polarization

Task 2.3B - Nominal + Mfg. Error + First Temperature -15° Off Axis

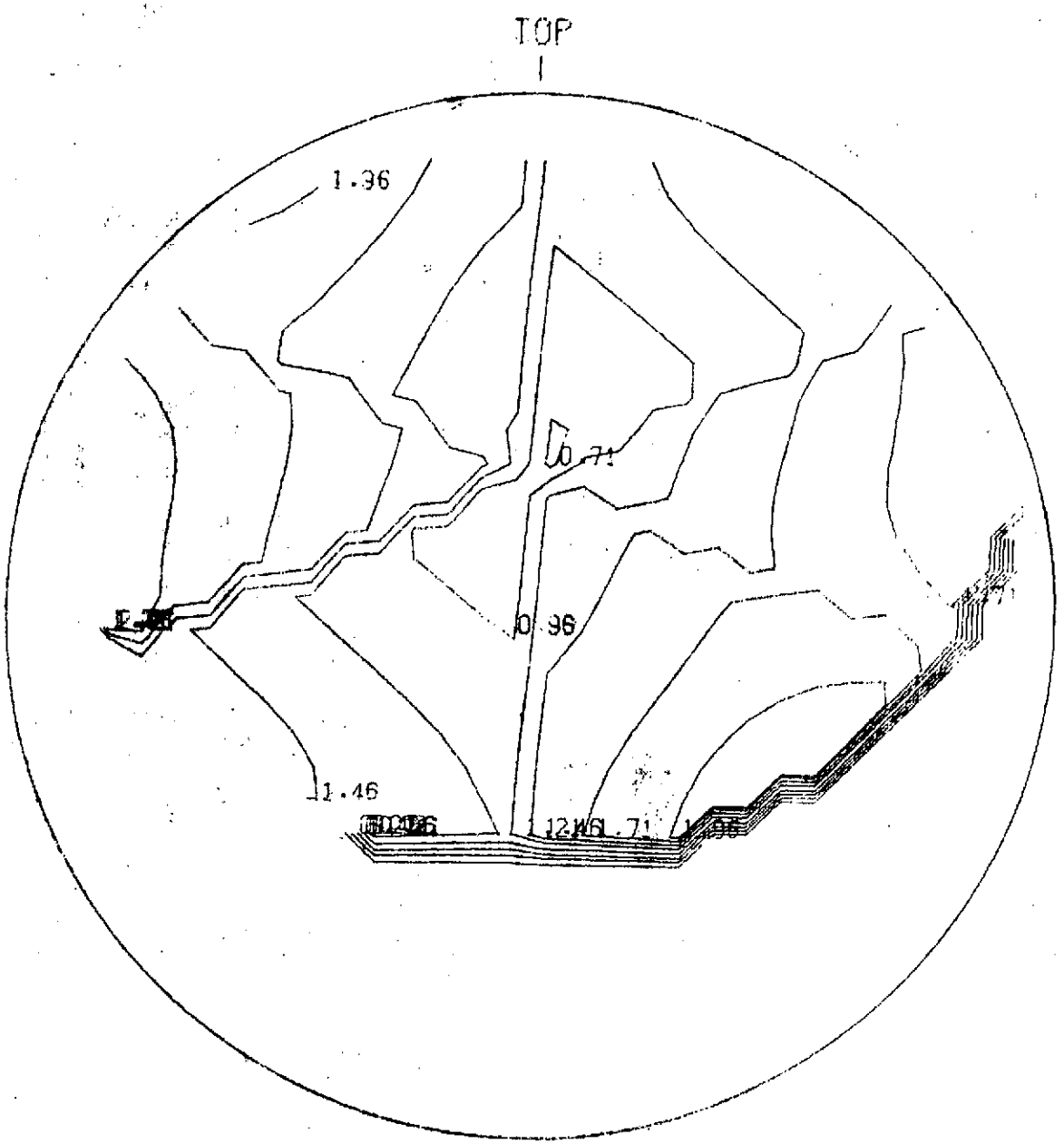

FIGURE 67

Task 2.3B - Nominal + Mfg. Error + First Temperature -15° Off Axis

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED TO LARGEST VALUE = 0.0169 = 100
TOTAL ENERGY = 0.18704000+01
MAP REPRESENTS 0.17436270+01 OR 93.2222 PERCENT OF TOTAL ENERGY

```
  0  0  0  0  0  1  1  1  1  0  0  0  0  1  0  0  0  0  0  0  0  0  1  1  0  0  1  1  1  1  0  0  0  0  0
  0  0  0  1  1  1  1  1  1  1  0  0  0  1  1  1  1  0  1  1  1  0  1  1  1  1  1  1  1  0  0  0  0  0  0
  0  0  0  1  1  1  1  1  1  1  0  0  1  1  1  2  2  1  2  3  3  1  1  1  0  1  1  1  1  1  1  0  0  0  0
  0  0  0  0  1  1  1  2  1  1  1  1  0  0  1  3  3  2  2  3  2  1  1  1  1  1  1  1  1  1  0  0  0  0  0
  0  0  0  0  0  1  1  1  1  1  2  1  0  0  0  2  2  2  3  2  1  0  1  0  1  1  1  2  2  1  0  0  0  0  0
  0  0  0  0  0  0  1  1  1  2  2  1  1  1  0  1  1  1  3  3  1  1  1  0  1  1  1  1  1  0  0  0  1  1  0
  1  0  1  0  1  1  2  2  2  3  2  2  2  1  1  4  3  2  3  5  4  1  1  1  2  2  2  2  1  0  1  0  1  1  0
  1  1  0  0  1  2  2  2  3  3  2  4  3  2  4  7  6  6  6  8  8  2  1  3  3  2  2  2  1  0  1  0  1  1  1
  0  1  0  0  1  1  2  2  3  4  4  5  5  6  8  6  6  9  7  7  9  7  6  6  3  3  2  2  1  0  0  0  0  1  0
  0  0  0  1  1  1  2  2  3  4  4  6  8 10  8  4  6  9  8  7  8 10 12  9  4  3  3  2  1  1  0  0  0  0  0
  1  1  0  1  0  1  2  1  1  4  6  7 11 14 10  9  8  6 11 16 12 11 12 10  6  3  2  1  1  2  1  0  0  1  1
  1  1  1  1  1  2  3  2  4 10 12 12 22 27 23 24 16  4 14 26 24 24 19 13 12  5  1  1  1  3  2  1  0  1  1
  1  2  2  2  2  3  3  5 12 19 18 22 41 45 41 42 26  8 16 27 34 47 40 23 20 12  3  2  2  4  4  3  1  1  1
  1  2  2  2  2  2  3  8 15 19 20 37 57 49 47 51 29 14 22 32 41 60 58 33 23 14  5  3  1  2  3  3  1  1  1
  1  2  2  1  1  2  4  8 12 17 29 57 63 41 52 54 19  9 27 53 58 56 61 46 27 14  5  3  2  3  3  2  1  2  2
  2  2  2  2  3  5  7  8 10 20 40 65 54 38 71 60 14 12 26 66 80 50 55 61 39 19  8  4  5  5  3  2  2  2  2
  1  1  1  1  3  5  6  5  8 19 32 41 28 36 83 60 28 43 29 57 82 40 37 53 39 22 10  4  3  3  2  1  1  1  1
  0  0  0  1  1  2  1  2  5  9  9  8  4 29 74 50 39 66 36 48 73 26  8 19 17 14  9  3  0  0  1  1  0  0  0
  1  0  1  1  1  1  1  3  5  5  3  9 20 43 76 59 36 44 34 67 77 31 10  5  1  7  8  5  3  1  1  2  1  1  0
  1  1  1  2  2  2  3  5  5  5 11 33 63 79 97 88 40 11 32 84 89 63 55 30  7  5  6  7  6  3  2  1  1  1  1
  1  0  1  1  1  2  2  3  1  5 18 49 91100 96 89 45  8 36 81 85 89 94 55 17  6  3  4  4  3  1  1  1  1  1
  0  0  1  1  1  2  2  1  1  8 26 54 90 91 65 50 31 16 32 54 63 87 92 56 26 14  6  3  2  2  1  1  1  0  0
  1  1  1  1  1  2  2  2  3 13 35 54 69 67 41 20 10 10 19 30 44 65 65 47 37 25 11  4  2  1  1  1  1  1  0
  0  1  1  1  1  2  2  1  2  9 28 38 38 37 32 21  8  5 11 22 32 37 36 35 32 20  8  4  2  1  0  1  1  0  0
  0  0  0  0  0  1  1  0  0  2  9 14 12 12 18 22 15  8 10 18 18 14 14 15 12  5  2  3  2  0  0  1  0  0  0
  0  0  0  0  0  1  1  0  1  1  1  2  4  3  5 12 15 11  8  9  7  4  4  2  1  1  0  1  1  0  1  0  0  0  0
  0  0  0  0  0  1  2  2  2  3  3  2  4  4  3  6 11 11  6  4  2  2  3  1  3  4  1  1  1  0  0  0  0  0  0
  0  0  1  0  0  0  2  3  3  4  4  3  2  3  6  6  6  7  6  4  2  2  3  4  6  5  3  3  2  0  0  0  0  0  0
  0  0  1  0  0  0  1  3  4  3  3  3  1  2  7  7  3  3  4  4  1  1  3  4  4  5  5  5  3  0  0  0  0  0  0
  0  0  1  1  0  0  0  2  3  2  1  1  1  2  5  6  3  1  2  2  1  1  2  2  3  3  4  3  1  0  0  0  0  0  0
  0  0  0  1  0  0  0  1  1  0  0  1  1  1  2  3  3  1  1  0  0  1  1  1  1  1  0  0  0  0  0  0  0  0  0
  0  0  0  1  1  0  1  1  1  0  0  1  1  0  0  1  1  1  1  1  0  0  1  1  0  0  0  1  1  0  1  1  0  0  0
  0  0  0  1  1  1  1  1  1  1  0  0  0  1  1  2  1  0  1  1  1  0  0  0  0  1  1  2  1  1  1  1  0  0  0
  0  0  0  0  1  1  2  1  1  1  0  0  1  1  1  1  1  0  1  1  1  1  0  0  0  1  1  2  3  2  1  1  0  0  0
  0  0  0  0  0  1  1  1  0  0  0  1  2  1  1  1  0  0  1  1  1  1  1  0  0  1  1  2  2  1  0  0  0  0  0
 10
 10
```

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Q-95

FIGURE 68

Point Spread Function

Task 2.3B - Nominal + Mfg. Error + First Temperature -15° Off Axis

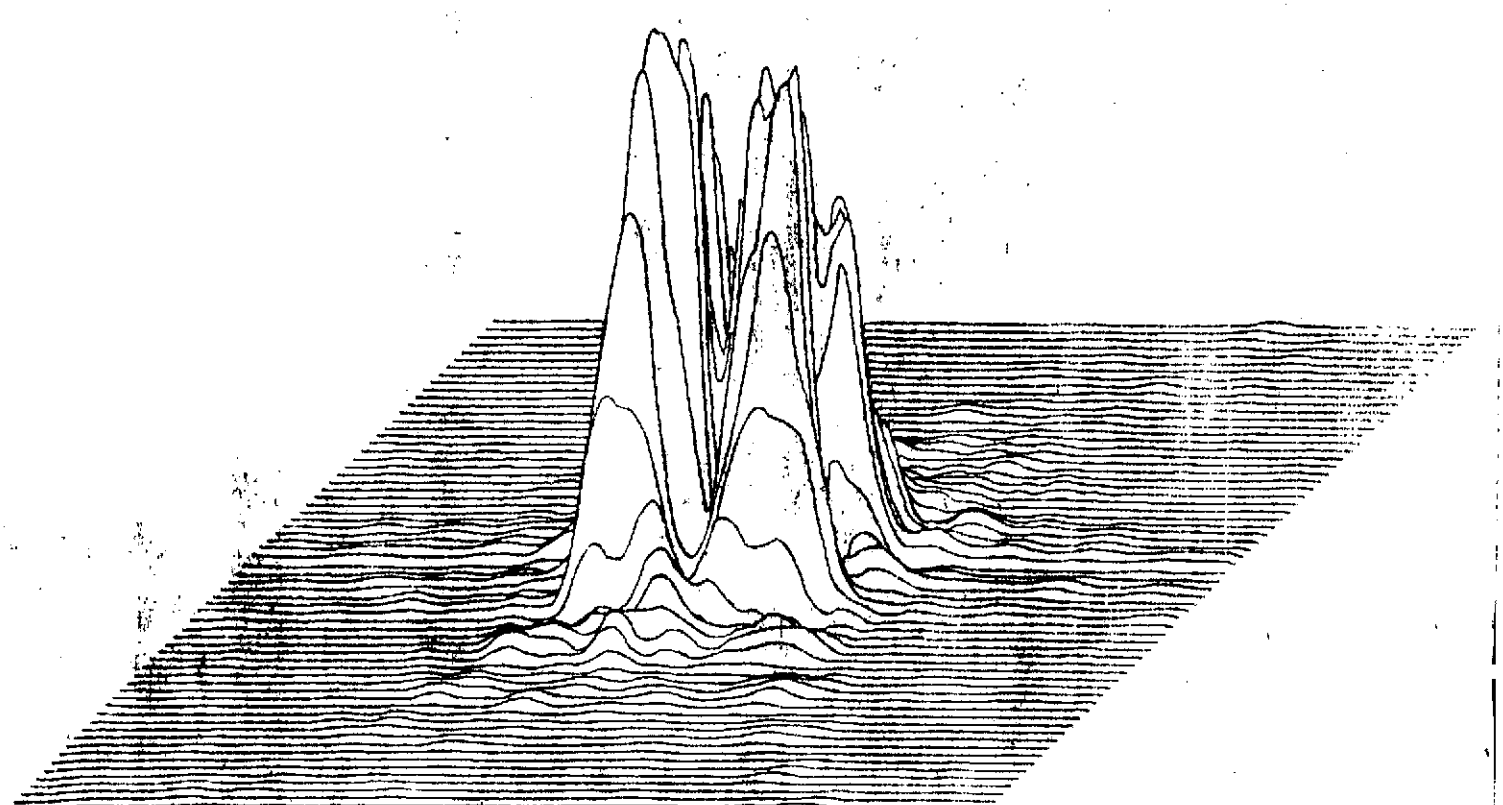


FIGURE 69

Intensity Distriubtion - Central 129 Microradians

Task 2.3B - Nominal + Mfg. Error + First Temperature -35° Off Axis

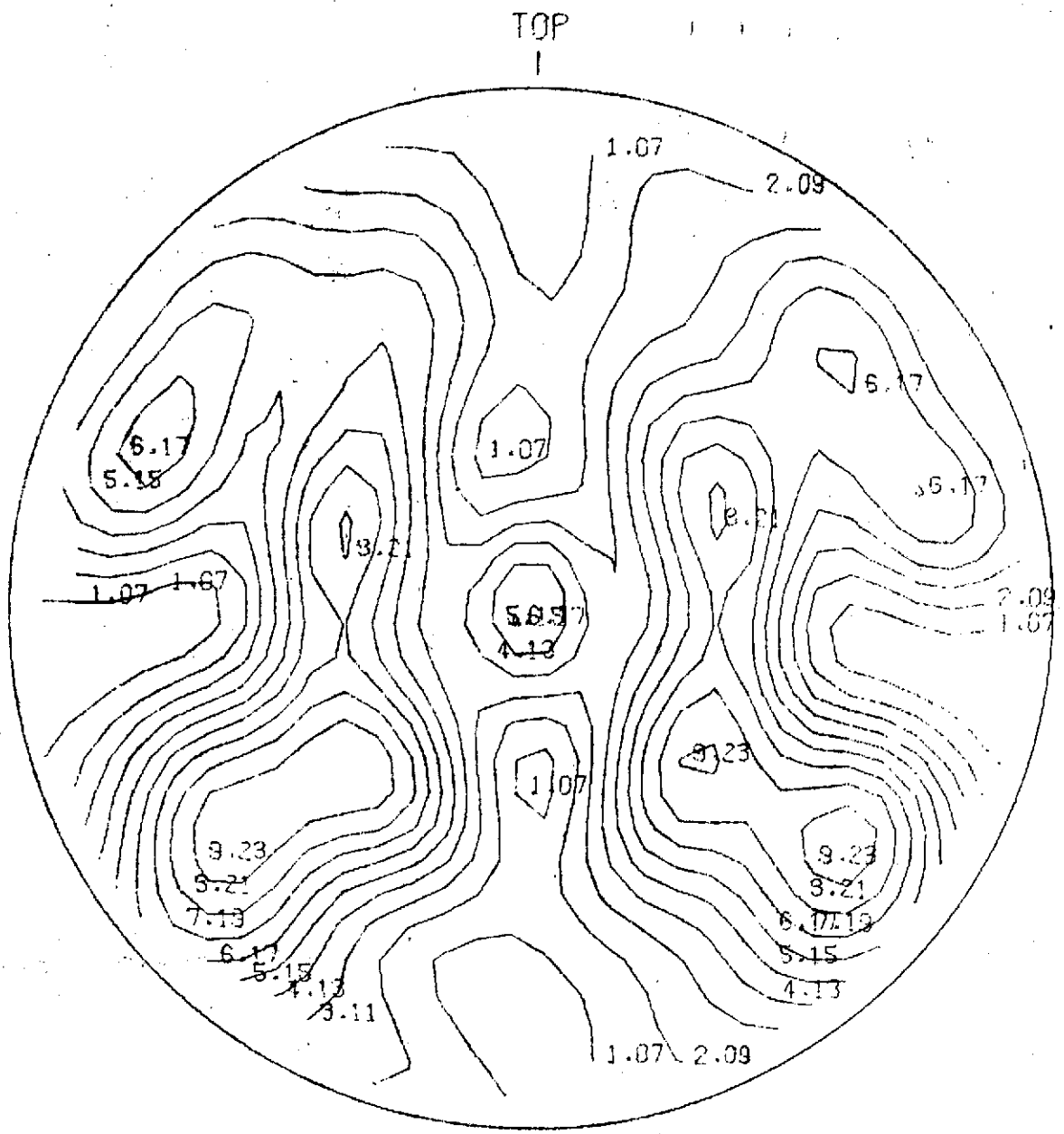


FIGURE 70

Encircled Energy

Vs

Field Angle

Task 2.3B - Nominal

+ Mfg. Error + First Temperature -15° Off Axis

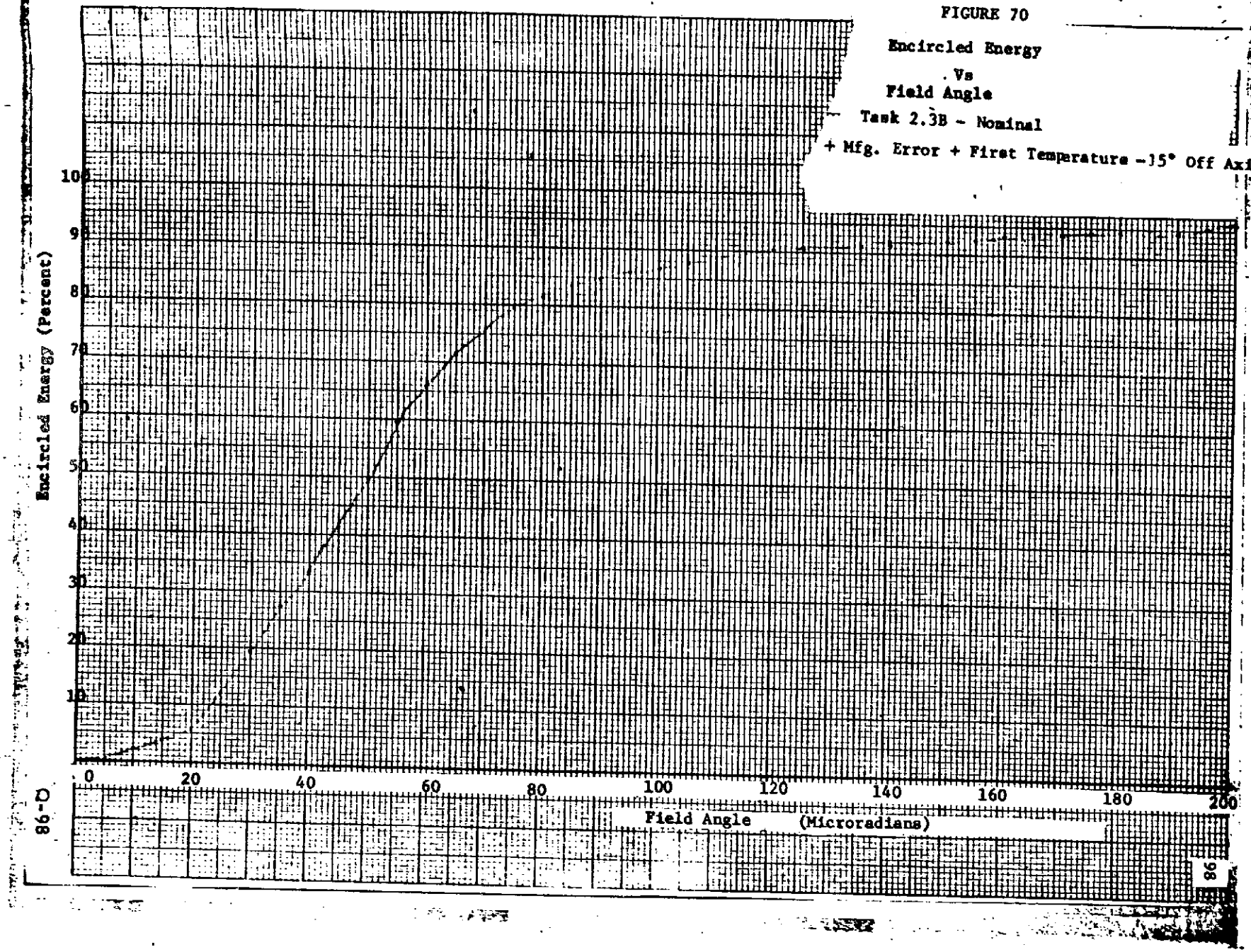


TABLE 16

ENCIRCLED ENERGY

Task 2.3A1 - Nominal + Mfg. Error + Second Temperature

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0
4.00	0.3	0.3	0.2	0.1	0.0	0.0	0.2	0.4	0.3
6.00	0.3	0.3	0.7	0.3	0.2	0.1	0.7	0.4	0.3
8.00	0.9	1.1	1.1	0.5	0.2	0.2	1.2	1.3	0.9
10.00	1.2	1.5	1.7	0.8	0.6	0.4	1.9	1.7	1.3
12.00	2.8	3.2	2.6	1.2	0.7	0.8	2.9	3.6	2.7
14.00	2.8	3.2	3.7	2.3	1.6	1.9	4.2	3.6	2.7
16.00	4.7	5.4	5.0	2.9	2.3	2.5	5.6	5.9	4.6
18.00	5.7	6.2	6.3	4.4	5.3	4.1	6.8	6.9	5.7
20.00	7.6	8.3	8.5	5.7	5.3	5.6	9.2	9.1	7.7
22.00	8.4	9.1	10.0	8.2	9.5	8.1	10.7	10.1	8.8
24.00	11.0	11.8	12.0	9.4	11.0	9.5	12.8	12.9	11.7
26.00	12.3	13.1	13.9	12.7	15.2	12.7	14.7	14.5	13.3
28.00	15.7	16.9	17.5	16.0	16.2	16.1	18.8	18.3	17.1
30.00	18.0	19.1	19.4	19.4	20.6	19.5	20.6	21.0	19.8
32.00	22.7	24.1	23.0	22.0	22.4	22.1	24.7	25.9	24.6
34.00	23.6	25.2	25.5	26.5	26.3	26.6	27.7	27.1	25.7
36.00	28.6	30.3	29.4	29.4	29.5	29.4	32.2	32.2	30.7
38.00	30.7	32.5	32.5	33.4	34.8	33.4	35.1	34.8	33.1
40.00	35.0	36.6	36.2	36.5	37.2	36.5	39.3	38.9	37.4
42.00	36.9	38.6	39.9	41.4	43.5	41.4	42.7	40.9	39.4
44.00	41.5	42.7	43.2	43.8	46.3	43.5	46.0	45.0	43.9
46.00	44.4	45.3	46.7	49.0	52.2	48.8	49.1	47.5	46.8
48.00	48.7	49.1	51.1	52.7	53.5	52.4	53.1	51.3	50.8
50.00	51.9	52.0	53.4	55.9	58.4	55.6	55.1	54.0	53.8
52.00	56.1	55.5	57.5	59.2	60.6	58.9	58.6	57.2	57.5
54.00	58.3	57.7	60.0	62.3	64.0	62.2	60.9	59.3	59.5
56.00	62.3	61.4	64.0	65.2	66.0	65.2	64.4	62.4	62.9
58.00	64.8	64.0	65.9	67.2	69.1	67.1	66.3	64.7	65.2
60.00	67.5	66.5	68.8	69.5	71.0	69.5	69.0	67.0	67.7
62.00	69.3	68.3	70.6	71.5	73.1	71.5	70.8	68.6	69.3
64.00	71.9	71.0	72.4	72.9	74.6	72.9	72.6	71.0	71.9
66.00	73.3	72.5	74.2	74.9	76.4	74.8	74.4	72.6	73.4
68.00	75.3	74.4	75.8	76.1	77.1	76.1	75.8	74.5	75.4
70.00	76.4	75.6	77.1	77.4	78.4	77.4	77.1	75.6	76.5
72.00	78.0	77.2	78.2	78.5	79.2	78.4	78.2	77.2	78.1
74.00	78.9	78.0	79.3	79.5	80.1	79.5	79.3	78.0	78.9
76.00	80.2	79.4	80.3	80.4	80.7	80.4	80.3	79.4	80.2
78.00	81.0	80.3	81.0	81.1	81.5	81.1	81.0	80.3	81.0
80.00	81.9	81.2	81.8	81.9	82.1	81.9	81.9	81.2	81.9

TABLE 17

ENCIRCLED ENERGY

Task 2.3A1 - Nominal + Mfg. Error + Second Temperature

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.3	0.3	0.5	0.2	0.1	0.1	0.5	0.4	0.3
10.00	1.2	1.5	1.7	0.8	0.6	0.4	1.9	1.7	1.3
15.00	3.9	4.5	4.7	2.5	2.3	2.1	5.2	5.0	3.8
20.00	7.6	8.3	8.5	5.7	5.3	5.6	9.2	9.1	7.7
25.00	11.9	12.7	13.3	12.4	13.0	12.4	14.1	14.0	12.8
30.00	18.0	19.1	19.4	19.4	20.6	19.5	20.6	21.0	19.8
35.00	26.7	28.2	27.7	27.2	28.6	27.3	29.9	30.0	28.7
40.00	35.0	36.6	36.2	36.5	37.2	36.5	39.3	38.9	37.4
45.00	43.2	44.3	45.0	47.3	49.9	47.1	47.8	46.6	45.4
50.00	51.9	52.0	53.4	55.9	58.4	55.6	55.1	54.0	53.8
55.00	60.9	60.0	62.4	63.8	65.6	63.6	63.1	61.1	61.7
60.00	67.5	66.5	68.8	69.5	71.0	69.5	69.0	67.0	67.7
65.00	72.6	71.6	73.6	74.1	75.7	74.1	73.7	71.8	72.6
70.00	76.4	75.6	77.1	77.4	78.4	77.4	77.1	75.6	76.5
75.00	79.6	78.8	79.9	80.0	80.4	80.0	79.9	78.9	79.6
80.00	81.9	81.2	81.8	81.9	82.1	81.9	81.9	81.2	81.9
85.00	83.5	82.9	83.5	83.7	83.8	83.7	83.7	83.1	83.6
90.00	84.8	84.7	85.0	85.2	85.3	85.2	85.2	84.9	85.1
95.00	86.2	86.4	86.4	86.6	86.8	86.6	86.5	86.4	86.4
100.00	87.3	87.7	87.7	87.7	88.2	87.8	87.7	87.6	87.4
105.00	88.3	88.7	88.8	88.8	89.1	88.9	88.8	88.6	88.3
110.00	89.3	89.6	89.7	89.6	89.8	89.6	89.6	89.5	89.3
115.00	90.2	90.3	90.3	90.3	90.4	90.3	90.3	90.3	90.2
120.00	90.8	90.9	90.8	90.9	90.9	90.9	91.0	91.0	90.9
125.00	91.3	91.3	91.4	91.5	91.5	91.4	91.5	91.5	91.4
130.00	91.9	91.8	91.9	92.0	92.0	92.0	92.0	91.9	92.0
135.00	92.3	92.4	92.4	92.4	92.6	92.4	92.4	92.4	92.3
140.00	92.8	92.8	92.9	92.9	92.9	92.9	92.9	92.8	92.8
145.00	93.1	93.2	93.2	93.3	93.2	93.2	93.3	93.2	93.1
150.00	93.5	93.5	93.5	93.6	93.6	93.6	93.5	93.5	93.5
155.00	93.9	93.9	93.9	93.9	93.9	93.9	93.8	93.8	93.8
160.00	94.2	94.2	94.2	94.2	94.1	94.2	94.1	94.1	94.2
165.00	94.5	94.5	94.5	94.5	94.4	94.5	94.5	94.4	94.5
170.00	94.7	94.7	94.8	94.8	94.8	94.8	94.8	94.7	94.7
175.00	95.0	95.0	95.0	95.0	95.1	95.0	95.1	95.0	95.0
180.00	95.3	95.3	95.3	95.3	95.4	95.3	95.4	95.3	95.3
184.99	95.5	95.6	95.5	95.6	95.6	95.6	95.5	95.6	95.6
189.99	95.8	95.8	95.8	95.8	95.8	95.9	95.8	95.8	95.8
194.99	96.0	96.0	96.0	96.0	96.1	96.0	96.0	96.0	96.0
199.99	96.3	96.3	96.2	96.2	96.3	96.3	96.2	96.3	96.3

FIGURE 71

Wavefront Map-Q Polarization

Task 2.3A1 - Nominal + Mfg. Error + Second Temperature

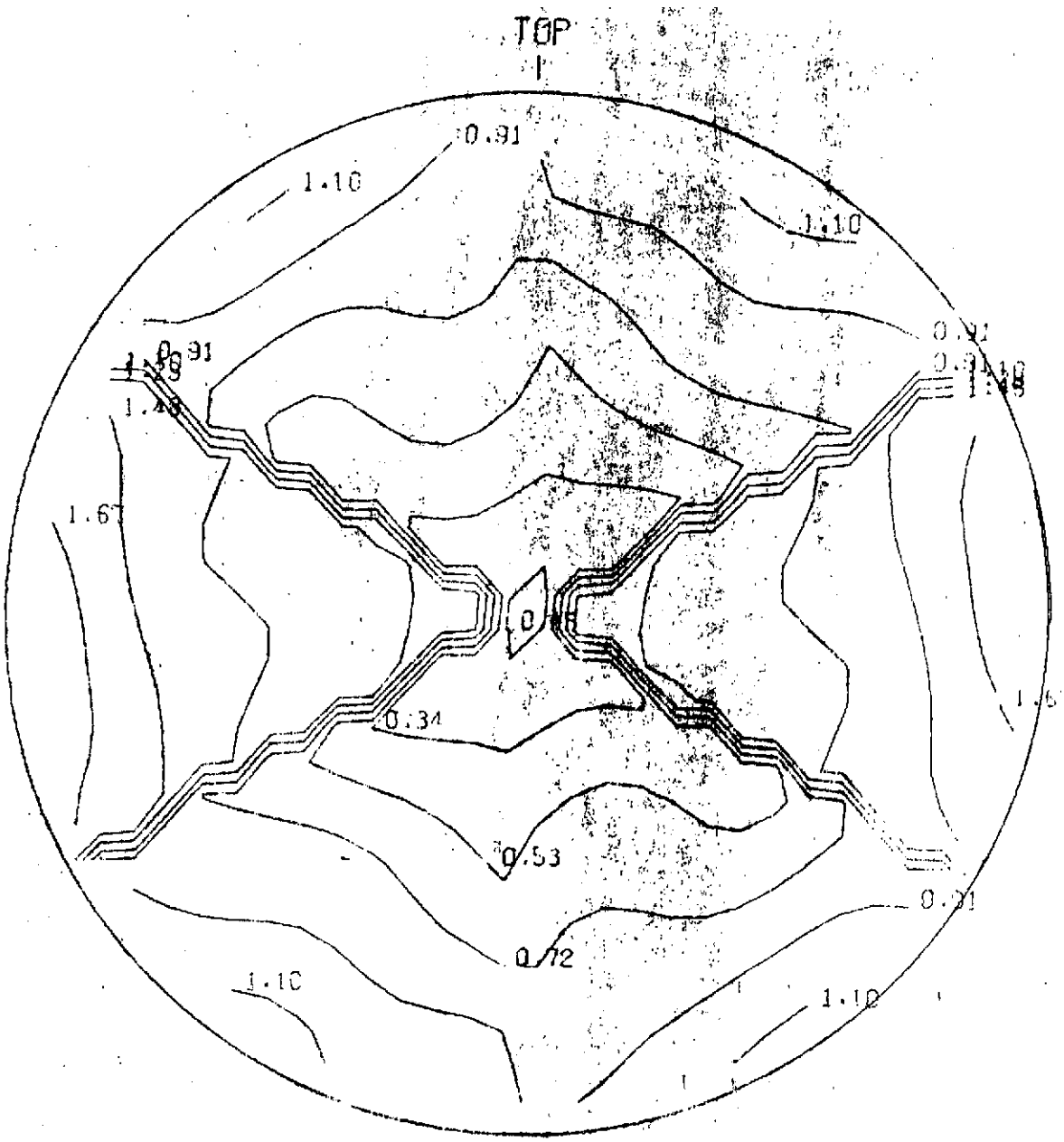
MAP IN UNITS OF 0.01 WAVES

```
                                                  104  98  93  89  86  99 101 101 101 104
                                          118 112 104  98  93  88  84  80  97  99  99  99 102 108 116 124
                                      117 111 104  98  93  88  85  81  77  91  94  95  96  99 105 112 118 123
                                  114 109 103  97  91  87  84  81  78  74  82  86  88  90  94 100 105 109 112 113
                              108 106 101  95  89  83  81  79  78  76  71  71  77  81  84  88  93  97 100 101 102 103
                          99  99  97  92  85  79  75  74  75  75  73  69  63  68  73  78  83  88  91  92  92  93  94  97
                      89  90  91  88  82  75  70  68  68  70  71  69  65  55  61  67  74  79  83  86  86  86  87  88  91  94
                  149  83  89  89  79  73  66  61  61  63  66  66  64  60  50  56  62  69  74  78  80  80  81  81  83  86  90 168
                149 146 143  76  71  64  57  53  54  58  61  62  59  54  45  50  56  61  67  70  73  74  75  76  78 156 163 168
                152 148 144 140  66  57  50  46  48  52  56  56  53  48  41  44  48  52  56  60  63  66  69  71 146 155 163 169
            161 155 150 144 138 132 127  44  40  41  45  48  49  46  41  36  38  39  41  44  48  53  58 128 136 146 156 164 171 174
            165 159 151 143 135 133 125 120 114  34  37  40  40  38  34  30  31  31  31  33  38 116 122 129 137 145 155 164 172 177
            170 162 152 141 133 128 125 121 116 111 108  30  31  30  27  23  23  23  22 111 116 121 126 131 137 144 153 163 172 179
            174 165 154 142 139 128 126 123 119 114 111 109  23  23  21  15  16  15 108 114 119 124 128 132 136 142 150 161 171 180
            178 168 156 145 136 131 128 126 122 118 114 110 105  98  15   7  92 102 110 115 120 124 128 131 134 139 148 159 170 180
            180 170 159 148 139 134 131 128 124 120 115 113 102  92   7  15  98 105 110 114 118 122 126 128 131 136 145 156 168 178
            180 171 161 150 142 135 132 128 124 119 114 108  15  16  15  21  23  23 109 111 114 119 123 126 128 133 142 154 165 174
            179 172 163 153 144 137 131 126 121 116 111  22  23  23  23  27  30  31  30 108 111 116 121 125 128 133 141 152 162 170
            177 172 164 155 145 137 129 122 116  38  33  31  31  31  30  34  38  40  40  37  34 114 120 125 130 135 143 151 159 165
            174 171 164 156 146 136 128  58  53  48  44  41  39  38  36  41  46  49  48  45  41  40  44 127 132 138 144 153 155 161
                169 163 155 146  71  69  66  63  60  56  52  48  44  41  48  53  56  56  52  48  46  50  57  66 140 144 148 152
                168 163 156  78  76  75  74  73  70  67  61  56  50  45  54  59  62  61  58  54  53  57  64  71  76 143 146 149
                168  90  86  83  81  81  80  80  78  74  69  62  56  50  60  64  66  66  63  61  61  66  73  79  83  83  83 149
                    94  91  88  87  86  86  86  83  79  74  67  61  55  65  69  71  70  68  68  70  75  82  88  91  90  89
                        97  94  93  92  92  91  88  83  78  73  68  63  69  73  75  75  74  75  79  85  92  97  99  99
                           103 102 101 100  97  93  88  84  81  77  71  71  76  78  79  81  83  89  95 101 106 108
                           113 112 109 105 103  94  90  88  86  82  74  78  81  84  87  91  97 103 109 114
                               123 118 112 105  99  96  95  94  91  77  81  85  88  93  98 104 111 117
                                   124 116 108 102  99  99  99  97  80  84  88  93  98 104 111 118
                                               104 101 101 101  99  86  89  93  98 104
```

FIGURE 72

Wavefront Plot-Q Polarization

Task 2.3A1 - Nominal + Mfg. Error + Second Temperature



REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

FIGURE 73

Wavefront Map-P Polarization

Task 2.3A1 - Nominal + Mfg. Error + Second Temperature

MAP IN UNITS OF 0.01 WAVES

```
                                                  162 156 151 148 144 107 109 109 109 112
                                              177 170 163 156 151 147 143 139 105 108 108 108 111 117 125 133
                                          175 169 163 156 151 147 143 140 135 100 103 104 104 108 114 121 127 131
                                      173 168 162 155 150 145 143 140 137 133  90  95  97  99 103 108 114 118 120 121
                                  166 164 159 153 147 142 139 138 137 134 130  80  85  89  92  97 102 106 108 109 110 111
                              157 158 155 150 144 138 134 133 133 133 131 127  71  77  82  87  91  96  99 100 101 101 103 105
                          147 149 149 146 141 134 128 126 127 129 129 127 123  64  70  76  82  88  92  94  94  94  95  97 100 103
                      165 142 142 141 138 131 124 119 119 122 124 125 123 118  58  64  70  77  83  87  89  89  89  90  92  95  98 134
                      165 162 159 135 133 122 115 112 113 116 120 123 118 113  54  59  64  70  75  79  81  83  84  85  86 122 129 134
                      168 164 160 156 124 116 108 105 106 110 114 115 112 106  49  53  56  60  64  68  72  75  77  79 112 121 129 135
                  177 171 166 160 154 148 143 103  99  99 103 107 108 105  99  44  46  48  50  53  57  62  67  94 102 112 122 130 137 140
                  181 175 167 159 151 146 141 136 130  93  95  98  99  97  92  38  39  39  40  42  46  82  88  95 103 111 121 130 138 143
                  186 178 168 157 149 144 141 137 132 127 124  89  90  88  85  31  32  31  31  77  82  87  92  97 103 110 119 129 138 145
                  190 181 170 158 149 144 142 139 135 130 127 125  82  81  80  24  24  24  74  80  85  90  94  98 102 108 116 127 137 146
                  194 184 172 161 152 147 144 142 138 134 130 126 121 114  74  15  58  68  76  81  86  90  94  97 100 105 114 125 136 146
                  196 186 175 164 155 150 147 144 140 136 131 126 118 108  27  86  64  71  76  80  84  88  92  94  97 102 111 122 134 144
                  196 187 177 166 158 152 148 144 140 135 130 124  35  36  36  91  93  93  75  77  80  85  89  92  94  99 108 120 131 140
                  195 188 179 169 160 153 147 142 137 132 127  42  43  43  43  97 100 101 100  74  77  82  87  91  94  99 107 118 128 136
                  193 188 180 171 161 153 145 138 132  58  54  51  51  51  50 104 109 111 110 107 105  80  86  91  96 101 109 117 125 131
                  190 187 180 172 162 152 144  79  73  68  64  61  59  58  56 111 117 119 119 115 111 110 114  93  98 104 110 116 121 127
                      185 179 171 162  91  89  86  83  80  76  72  68  64  61 118 123 126 126 122 118 116 120 127 136 106 110 114 118
                      184 179 172  98  96  95  94  93  91  87  82  76  70  65 124 129 132 132 128 124 124 127 134 142 146 109 112 115
                      184 110 106 103 101 101 101 100  98  94  89  82  76  70 130 134 137 136 133 131 131 136 143 149 153 154 153 115
                          115 111 108 107 106 106 106 104  99  94  88  82  76 135 139 141 141 139 138 140 145 152 158 161 160 159
                              117 115 113 112 112 112 108 103  98  93  88  83 139 143 145 145 145 145 149 155 162 167 169 169
                                  123 122 121 120 118 113 108 104 101  97  92 142 146 148 150 151 154 159 165 171 176 178
                                      133 132 130 125 120 114 110 108 106 102 144 149 152 154 157 161 167 174 179 184
                                  143 138 132 125 119 116 115 114 111 147 151 155 159 163 168 175 181 187
                                      144 136 126 122 120 119 119 117 151 155 159 163 168 175 181 188
                                          124 121 121 121 119 156 160 163 168 174
```

FIGURE 74

Wavefront Plot-P Polarization

Task 2.3A1 - Nominal + Mfg. Error + Second Temperature

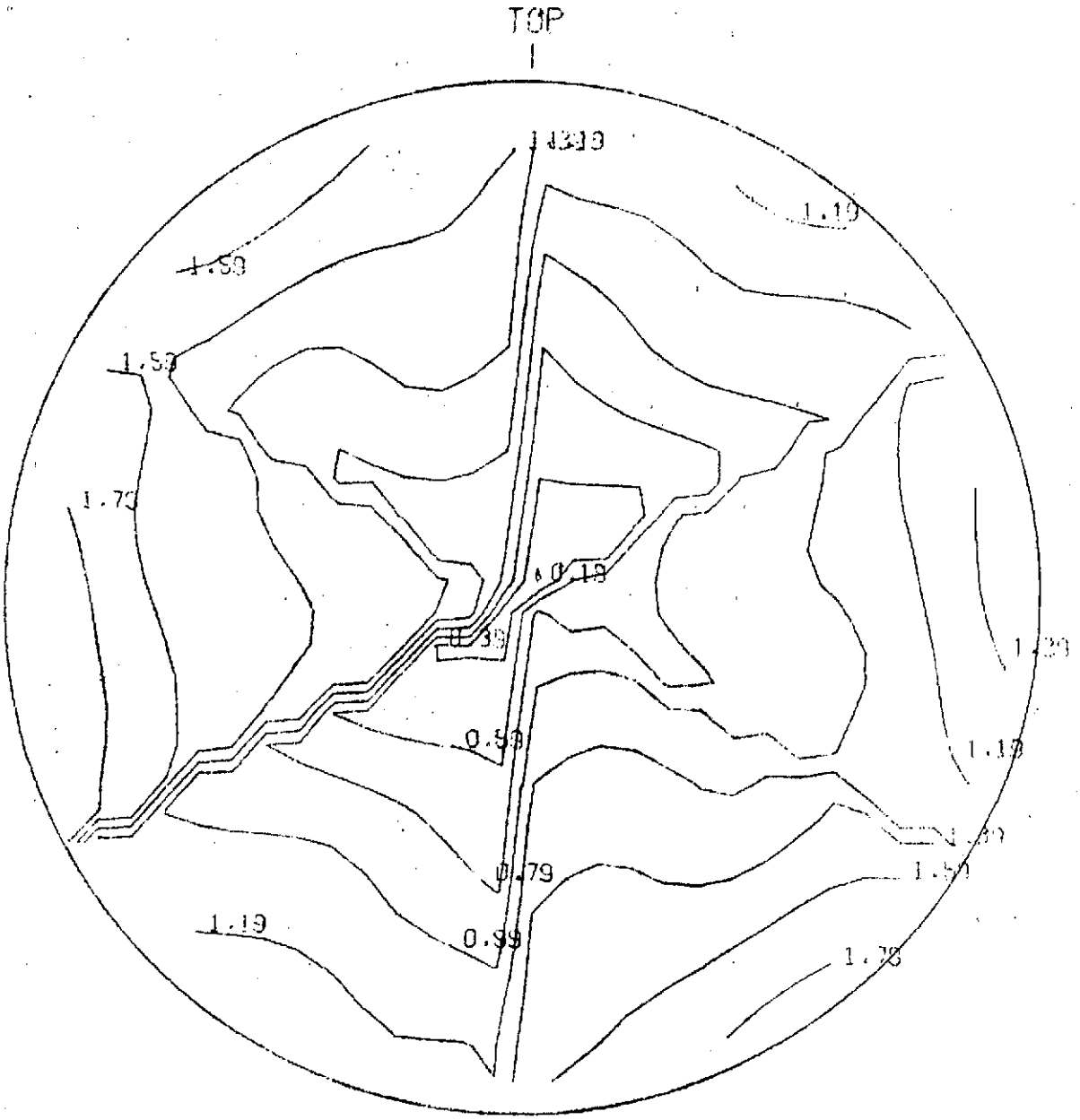


FIGURE 75

Task 2.3A1 - Nominal + Mfg. Error + Second Temperature

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0323 = 100
TOTAL ENERGY = 0.2461D000+01
MAP REPRESENTS 0.23159510+01 OR 94.1061 PERCENT OF TOTAL ENERGY

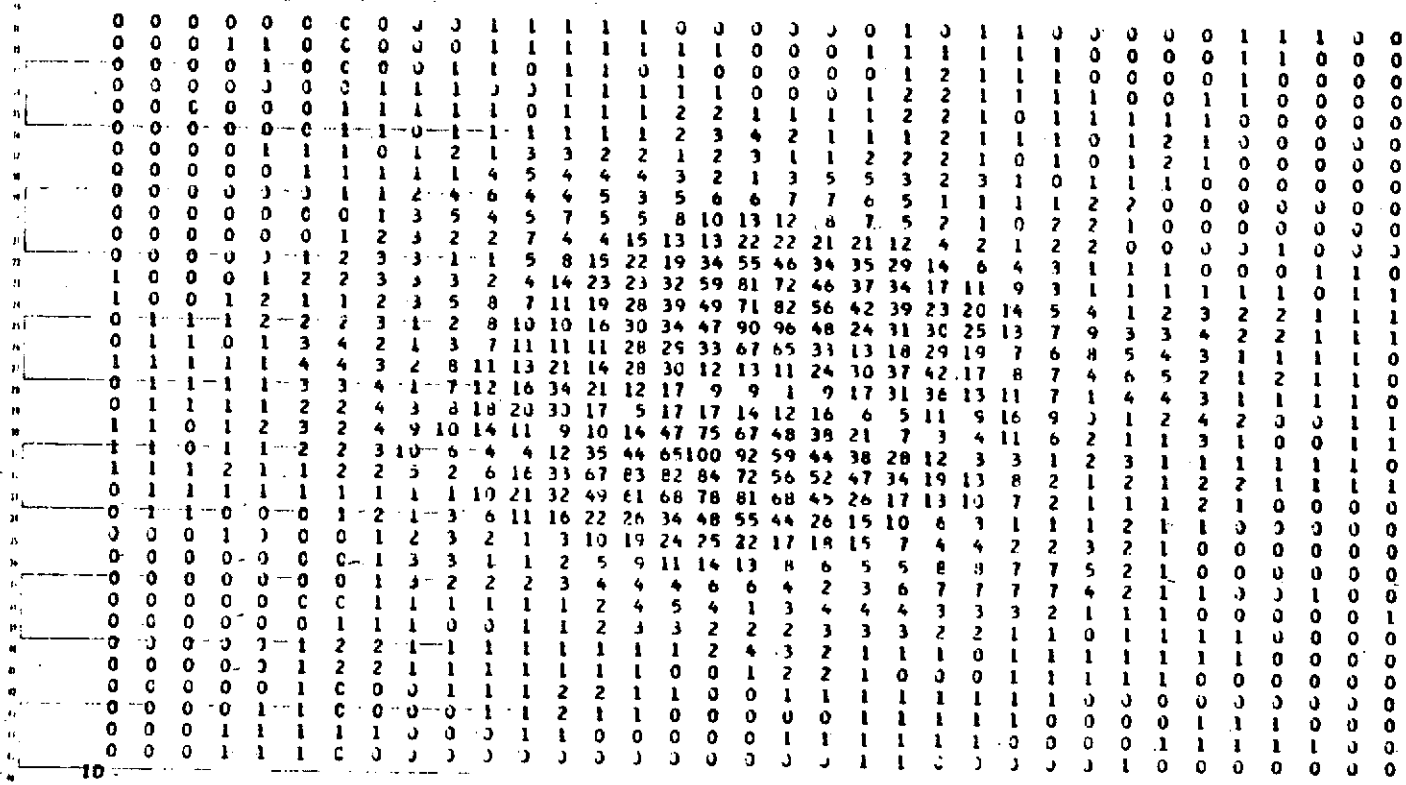


FIGURE 76

Point Spread Function

Task 2.3A1 - Nominal + Mfg. Error + Second Temperature

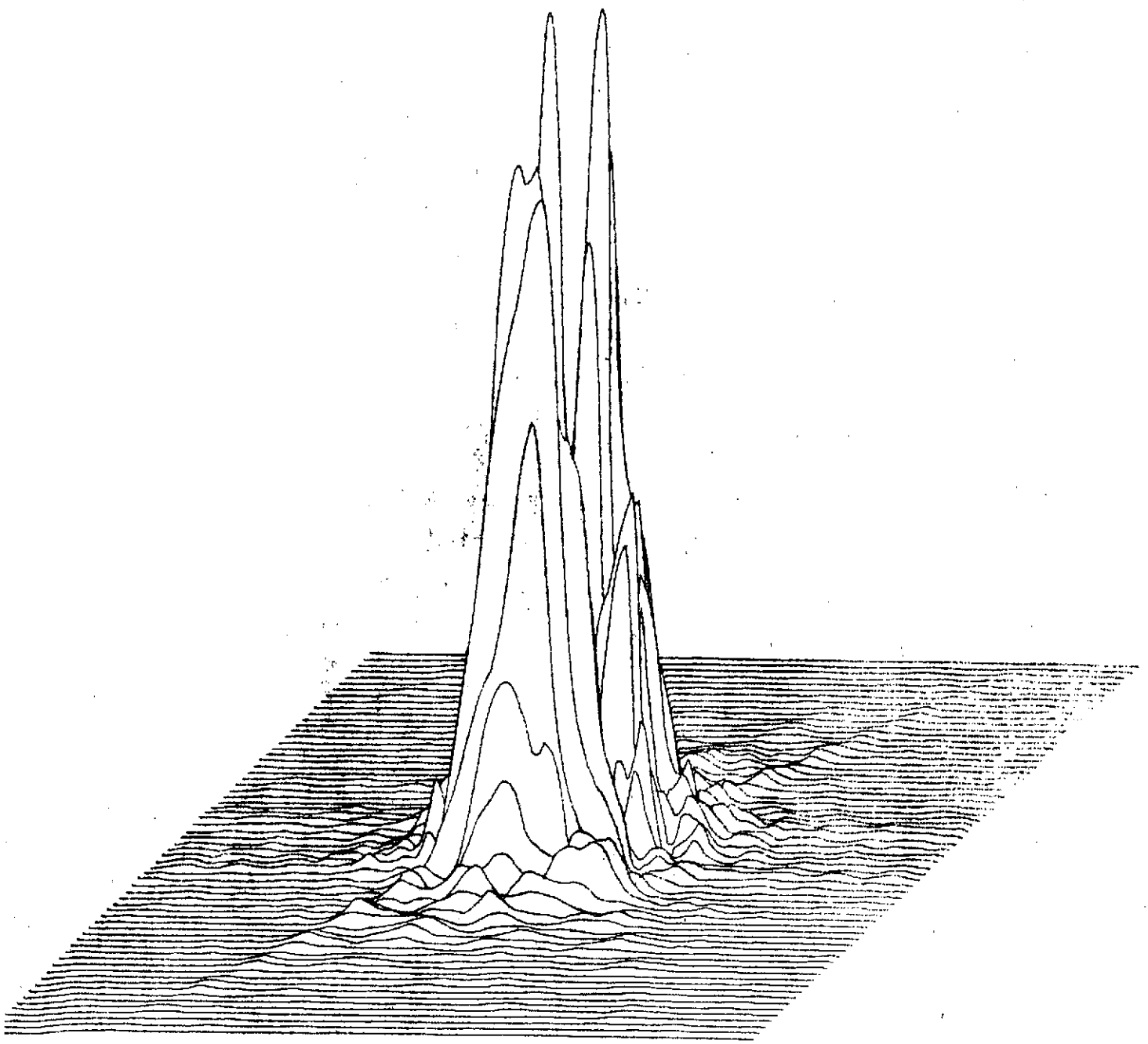


FIGURE 77

Intensity Distriubtion - Central 129 Microradians

Task 2.3A1 - Nominal + Mfg. Error + Second Temperature

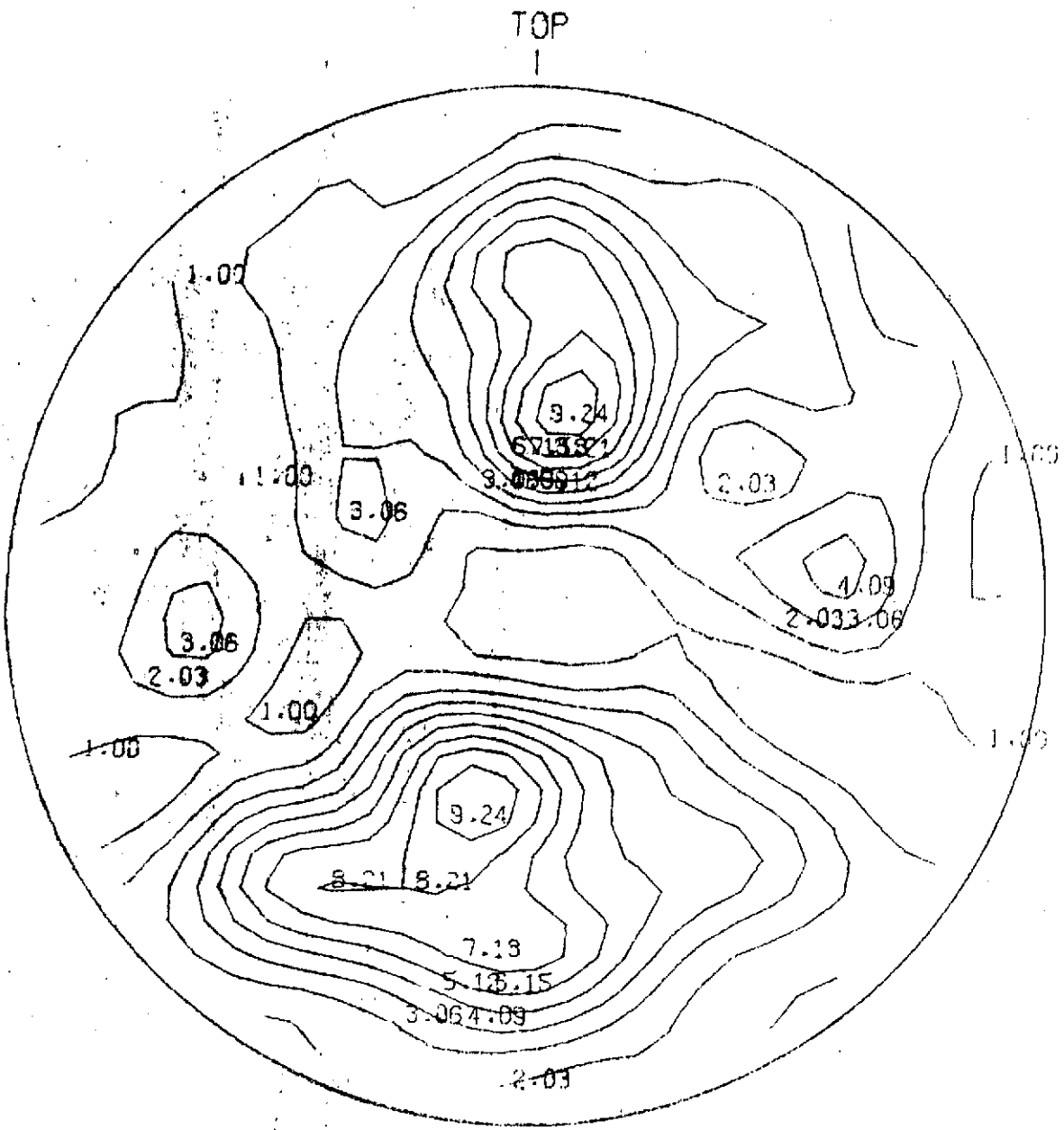


FIGURE 78
Encircled Energy
Vs
Field Angle
Task 2.3A1 - Nominal
+ Mfg. Error + Second Temperature

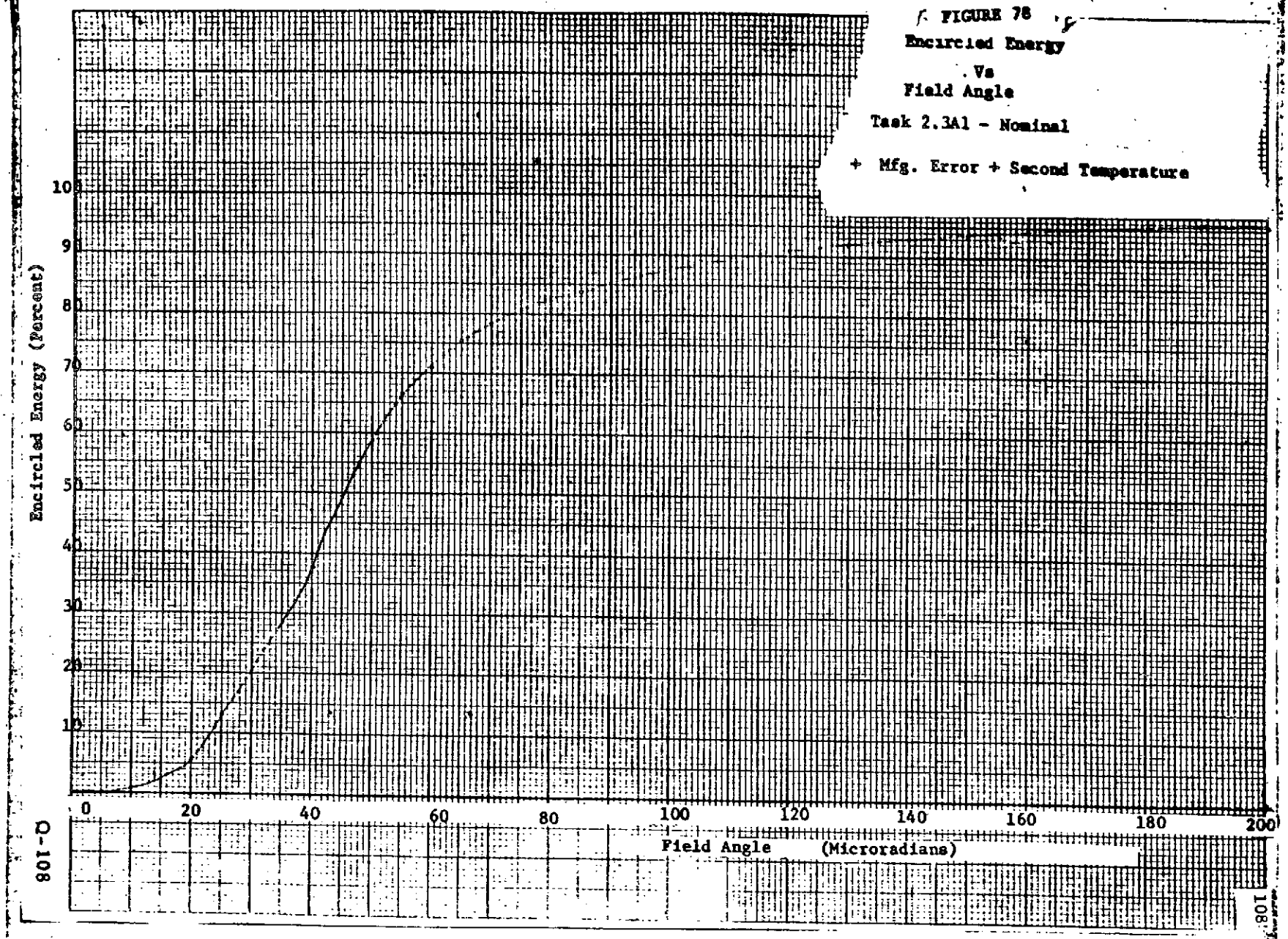


TABLE 18

ENCIRCLED ENERGY

Task 2.3A2 - Nominal + Mfg. Error + Third Temperature

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0
4.00	0.3	0.3	0.2	0.1	0.0	0.0	0.2	0.4	0.3
6.00	0.3	0.3	0.7	0.3	0.2	0.1	0.7	0.4	0.3
8.00	0.9	1.0	1.2	0.5	0.2	0.3	1.3	1.3	0.9
10.00	1.3	1.4	1.7	0.8	0.6	0.5	1.9	1.8	1.3
12.00	2.9	3.2	2.7	1.3	0.8	0.9	3.0	3.7	2.9
14.00	2.9	3.2	3.8	2.4	1.7	2.0	4.3	3.7	2.9
16.00	4.9	5.5	5.1	3.0	2.4	2.7	5.8	6.1	4.9
18.00	5.9	6.3	6.4	4.6	5.4	4.3	7.0	7.0	5.9
20.00	7.8	8.4	8.6	5.9	5.4	5.8	9.5	9.3	8.0
22.00	8.7	9.2	10.2	8.5	9.7	8.4	11.0	10.2	9.1
24.00	11.2	12.0	12.1	9.7	11.3	9.9	13.0	13.1	11.9
26.00	12.5	13.2	14.1	13.0	15.6	13.1	14.9	14.6	13.6
28.00	15.8	16.9	17.6	16.4	16.7	16.5	18.9	18.3	17.1
30.00	18.1	19.2	19.6	19.7	21.1	19.9	20.7	21.0	19.9
32.00	22.8	24.1	23.1	22.3	22.9	22.5	24.7	25.9	24.6
34.00	23.7	25.2	25.7	26.7	26.7	26.8	27.7	27.1	25.7
36.00	28.7	30.3	29.6	29.5	29.7	29.6	32.1	32.2	30.7
38.00	30.8	32.6	32.6	33.4	34.7	33.4	35.0	34.8	33.1
40.00	35.1	36.7	36.3	36.5	37.0	36.4	39.2	38.9	37.4
42.00	37.0	38.7	39.9	41.2	43.1	41.1	42.6	40.9	39.3
44.00	41.6	42.7	43.2	43.6	45.8	43.2	46.0	44.9	43.8
46.00	44.4	45.3	46.5	48.7	51.7	48.4	49.1	47.4	46.7
48.00	48.6	48.9	50.8	52.3	53.0	51.9	53.0	51.1	50.7
50.00	51.7	51.8	53.1	55.5	58.0	55.2	54.9	53.8	53.7
52.00	55.8	55.2	57.1	58.8	60.2	58.5	58.5	57.0	57.4
54.00	58.0	57.4	59.6	61.9	63.7	61.8	60.8	59.1	59.3
56.00	61.9	61.1	63.7	64.9	65.8	64.9	64.2	62.2	62.8
58.00	64.5	63.7	65.5	66.9	68.9	66.9	66.1	64.6	65.0
60.00	67.2	66.3	68.6	69.3	70.8	69.4	68.9	66.9	67.6
62.00	69.0	68.2	70.4	71.5	73.0	71.5	70.7	68.6	69.2
64.00	71.8	71.0	72.4	72.9	74.5	72.9	72.6	71.1	71.8
66.00	73.2	72.6	74.2	74.9	76.4	74.9	74.4	72.7	73.3
68.00	75.2	74.5	75.9	76.1	77.2	76.2	75.9	74.6	75.3
70.00	76.3	75.7	77.2	77.5	78.5	77.5	77.1	75.7	76.4
72.00	78.0	77.4	78.4	78.6	79.5	78.6	78.3	77.3	78.1
74.00	78.9	78.2	79.5	79.7	80.4	79.7	79.4	78.2	78.9
76.00	80.3	79.5	80.6	80.6	81.1	80.6	80.5	79.5	80.2
78.00	81.1	80.4	81.2	81.3	81.8	81.3	81.1	80.4	81.0
80.00	82.1	81.3	82.1	82.1	82.4	82.1	82.1	81.4	82.0

TABLE 19

ENCIRCLED ENERGY

Task 2.3A2 - Nominal + Mfg. Error + Third Temperature

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.3	0.3	0.5	0.3	0.1	0.1	0.5	0.4	0.3
10.00	1.3	1.4	1.7	0.8	0.6	0.5	1.9	1.8	1.3
15.00	4.1	4.6	4.7	2.6	2.4	2.3	5.3	5.1	4.0
20.00	7.8	8.4	8.6	5.9	5.4	5.8	9.5	9.3	8.0
25.00	12.0	12.8	13.5	12.7	13.4	12.8	14.3	14.1	13.0
30.00	18.1	19.2	19.6	19.7	21.1	19.9	20.7	21.0	19.9
35.00	26.8	28.3	27.8	27.4	28.9	27.5	29.8	30.0	28.7
40.00	35.1	36.7	36.3	36.5	37.0	36.4	39.2	38.9	37.4
45.00	43.2	44.3	45.0	47.0	49.4	46.7	47.7	46.5	45.4
50.00	51.7	51.8	53.1	55.5	58.0	55.2	54.9	53.8	53.7
55.00	60.6	59.7	62.0	63.5	65.4	63.3	62.9	60.9	61.6
60.00	67.2	66.3	68.6	69.3	70.8	69.4	68.9	66.9	67.6
65.00	72.4	71.7	73.6	74.1	75.7	74.1	73.7	71.8	72.5
70.00	76.3	75.7	77.2	77.5	78.5	77.5	77.1	75.7	76.4
75.00	79.7	79.0	80.1	80.2	80.8	80.2	80.0	79.0	79.7
80.00	82.1	81.3	82.1	82.1	82.4	82.1	82.1	81.4	82.0
85.00	83.7	83.1	83.8	83.9	83.9	83.9	83.9	83.2	83.7
90.00	85.0	84.7	85.1	85.3	85.4	85.3	85.3	84.9	85.2
95.00	86.2	86.3	86.4	86.5	86.8	86.6	86.5	86.4	86.4
100.00	87.3	87.6	87.6	87.6	88.0	87.7	87.6	87.5	87.3
105.00	88.2	88.6	88.7	88.6	88.9	88.7	88.7	88.5	88.2
110.00	89.2	89.4	89.5	89.4	89.6	89.5	89.4	89.4	89.2
115.00	90.0	90.1	90.1	90.1	90.2	90.1	90.1	90.2	90.0
120.00	90.6	90.7	90.7	90.8	90.8	90.7	90.8	90.8	90.7
125.00	91.2	91.2	91.3	91.3	91.4	91.3	91.4	91.3	91.3
130.00	91.8	91.7	91.8	91.9	92.0	91.9	91.9	91.8	91.9
135.00	92.3	92.3	92.3	92.4	92.5	92.4	92.3	92.3	92.3
140.00	92.7	92.8	92.8	92.9	92.9	92.9	92.9	92.8	92.8
145.00	93.1	93.1	93.2	93.2	93.2	93.2	93.3	93.2	93.1
150.00	93.5	93.5	93.6	93.6	93.6	93.6	93.6	93.5	93.5
155.00	93.9	93.9	93.9	93.9	93.9	93.9	93.8	93.8	93.8
160.00	94.2	94.2	94.2	94.2	94.2	94.2	94.1	94.2	94.2
165.00	94.5	94.5	94.6	94.5	94.5	94.5	94.5	94.5	94.5
170.00	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8
175.00	95.1	95.0	95.1	95.1	95.1	95.1	95.2	95.1	95.1
180.00	95.3	95.3	95.3	95.4	95.5	95.4	95.4	95.4	95.4
184.99	95.6	95.6	95.5	95.6	95.6	95.7	95.6	95.6	95.6
189.99	95.8	95.8	95.8	95.9	95.9	95.9	95.8	95.9	95.9
194.99	96.0	96.1	96.1	96.1	96.1	96.1	96.1	96.1	96.1
199.99	96.3	96.3	96.3	96.3	96.3	96.3	96.3	96.3	96.3

FIGURE 78

Wavefront Map-() Polarization

Task 2.3A2 - Nominal + Mfg. Error + Third Temperature

MAP IN UNITS OF 0.01 WAVES

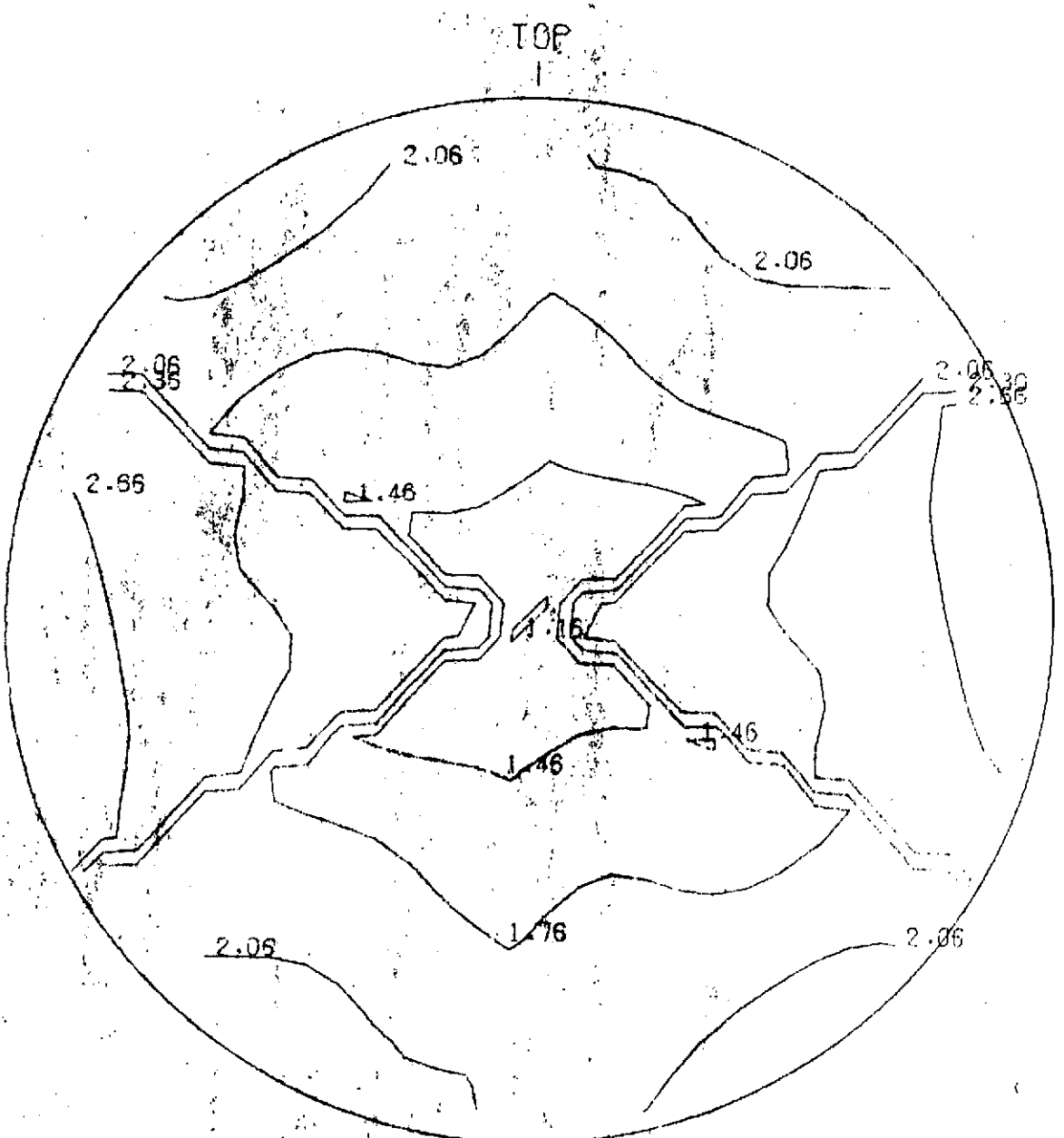
```
                                  212 205 199 195 191 204 206 207 208 212
                              228 221 214 207 201 195 191 186 203 205 206 207 211 218 226 234
                          227 221 214 208 202 196 192 188 183 197 201 202 204 208 215 222 229 233
                      223 219 213 207 201 196 193 190 187 183 190 195 197 199 203 209 215 219 222 222
                  215 214 210 204 198 194 191 190 189 186 182 182 188 191 194 199 204 207 209 210 210 210
              204 206 205 200 194 190 186 186 186 185 183 179 173 179 184 190 195 199 201 201 201 201 201 202
          194 196 197 195 191 185 181 179 179 181 181 178 174 165 171 177 184 190 195 197 196 194 194 195 197 199
      253 188 189 189 187 182 176 172 171 173 175 176 174 169 159 165 171 178 184 189 191 191 190 189 189 192 195 272
      254 252 249 183 180 174 168 163 163 167 171 171 169 164 154 159 165 171 176 180 183 185 185 185 184 262 268 273
      258 254 251 247 175 168 160 155 157 161 165 166 163 157 150 153 157 161 165 169 173 177 180 181 254 262 269 274
267 262 257 251 247 243 237 154 150 153 154 158 158 155 149 144 147 148 150 153 158 163 168 239 247 255 263 271 278 281
273 266 258 251 245 241 235 230 224 144 146 149 149 147 142 138 139 139 140 143 147 226 231 239 248 255 263 272 280 285
279 271 260 251 244 239 234 230 225 220 217 139 139 138 135 131 131 131 131 220 225 230 235 241 248 255 262 271 281 288
284 275 263 252 245 239 235 232 228 223 220 217 131 130 129 123 123 123 216 223 229 233 237 242 247 254 260 270 281 290
288 278 266 255 247 241 238 235 231 227 222 218 213 205 122 114 199 210 218 224 229 234 237 240 245 251 258 268 280 293
293 280 268 258 251 245 240 237 234 229 224 218 210 199 114 122 205 213 218 222 227 231 235 238 241 247 255 266 278 288
293 281 270 260 254 247 242 237 233 229 223 216 123 123 123 129 130 131 217 220 223 228 232 235 239 245 252 263 275 284
288 281 271 262 255 248 241 235 230 225 220 131 131 131 131 135 138 139 139 217 220 225 230 234 239 244 251 260 271 279
285 280 272 263 255 248 239 231 226 147 143 140 139 139 138 142 147 145 149 146 144 224 230 235 241 245 251 258 266 273
281 278 271 263 255 247 239 168 163 158 153 150 148 147 144 149 155 158 158 154 150 150 154 237 243 247 251 257 262 267
    274 269 262 254 181 183 177 173 169 165 161 157 153 150 157 163 166 165 161 157 155 160 168 175 247 251 254 258
    273 268 262 184 185 185 185 183 180 176 171 165 159 154 164 169 171 171 167 163 163 168 174 180 183 249 252 254
272 195 192 189 189 190 191 191 189 184 178 171 165 159 169 174 176 175 173 171 172 176 182 187 189 189 188 253
    199 197 195 194 194 196 197 195 190 184 177 171 165 174 178 181 181 179 179 181 185 191 195 197 196 194
        202 201 201 201 201 201 159 155 193 184 179 173 179 183 185 186 186 186 190 194 200 205 206 204
            213 213 213 209 207 204 159 194 191 188 182 182 186 189 190 191 194 198 204 210 214 215
                222 222 219 215 209 203 199 197 195 190 183 187 190 193 196 201 207 213 219 223
                    233 229 222 215 208 204 202 201 197 183 188 192 196 202 208 214 221 227
                        234 226 218 211 207 206 205 203 186 191 195 201 207 214 221 228
                            212 208 207 206 204 191 195 199 205 212
```

Q-111

FIGURE 80

Wavefront Plot-Q Polarization

Task 2.3A2 - Nominal + Mfg. Error + Third Temperature



REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

FIGURE 81

Wavefront Map-P Polarization

Task 3.3A2 - Nominal + Mfg. Error + Third Temperature

MAP IN UNITS OF 0.01 WAVES

```
                                    270 263 258 253 249 212 214 215 216 220
                                287 280 272 265 259 254 249 245 211 214 215 216 219 226 235 243
                            285 280 273 266 260 255 251 246 241 206 209 211 212 216 223 231 237 241
                        282 277 272 265 259 254 251 249 246 241 199 203 205 207 212 218 224 228 230 230
                    274 273 269 263 257 252 249 248 247 245 241 191 196 200 203 207 212 216 218 219 219 218
                263 265 263 259 253 248 245 245 244 244 242 238 182 187 193 198 203 207 210 210 209 209 210 211
            252 254 256 254 249 244 240 238 238 239 239 237 233 174 180 186 192 199 203 205 204 203 202 204 205 208
        269 247 248 248 245 240 235 231 229 231 233 234 232 228 168 173 179 186 192 197 200 200 199 197 198 200 203 238
        270 268 265 241 239 233 226 222 222 225 229 230 227 222 163 168 173 179 184 188 191 193 194 193 193 228 234 239
        274 270 267 263 234 227 219 214 215 223 224 224 221 216 158 162 165 169 174 177 181 185 188 189 223 228 235 240
283 278 273 267 263 259 253 212 208 209 213 216 217 214 208 153 155 157 159 162 166 171 177 205 213 221 229 237 244 247
289 282 274 267 261 257 251 246 240 202 205 207 207 205 200 146 147 148 148 151 156 192 197 205 214 221 229 238 246 251
295 287 276 267 260 255 250 246 241 236 233 197 198 196 193 139 140 139 139 186 191 196 201 207 214 221 228 237 247 254
300 291 279 268 261 255 251 248 244 239 236 233 190 189 187 131 132 131 182 189 195 199 203 208 213 220 226 236 247 256
304 294 282 271 263 257 254 251 247 243 238 234 229 221 181 122 165 176 184 190 195 200 203 206 211 217 224 234 246 256
306 296 284 274 267 261 256 253 250 245 240 234 226 215 134 193 171 179 184 188 193 197 201 204 207 213 221 232 244 256
305 297 286 276 270 263 258 253 249 245 239 232 143 143 143 199 200 201 183 186 190 194 198 201 205 211 218 229 241 250
304 297 287 278 271 264 257 251 246 241 236 151 151 151 151 205 208 209 209 183 186 191 196 200 205 210 217 226 237 245
301 296 288 279 271 264 255 247 242 167 163 160 159 159 158 212 217 219 219 216 214 190 196 201 207 211 217 225 232 239
297 294 287 279 271 263 255 188 183 178 174 170 168 167 164 220 225 229 228 224 221 220 224 203 209 213 217 223 228 233
    290 285 278 270 201 200 197 193 189 185 181 177 174 170 227 233 236 235 231 227 226 230 239 246 213 217 220 224
    289 284 278 204 205 206 205 203 200 196 191 185 180 175 234 239 241 241 237 234 234 238 245 250 253 215 218 220
    288 215 212 210 209 213 211 211 209 204 198 191 185 179 239 244 246 245 243 241 242 247 252 257 259 259 258 219
        219 217 215 214 214 216 217 215 210 204 197 191 185 244 249 251 251 249 249 251 255 261 265 268 266 264
            222 222 221 221 221 221 219 215 210 204 199 193 249 253 256 256 256 257 260 265 270 275 276 275
                233 233 233 229 227 224 219 214 211 208 202 252 256 259 260 261 264 268 274 280 285 285
                    242 242 240 235 229 223 219 217 215 210 253 257 260 263 266 271 277 284 299 293
                        253 249 242 235 229 224 222 221 217 253 258 262 267 272 278 285 291 297
                            254 247 238 231 227 226 225 223 256 261 265 271 277 284 292 299
                                232 226 227 228 224 261 265 269 275 282
```

FIGURE 82

Wavefront Plot-P Polarization

Task 2.3A2 - Nominal + Mfg. Error + Third Temperature

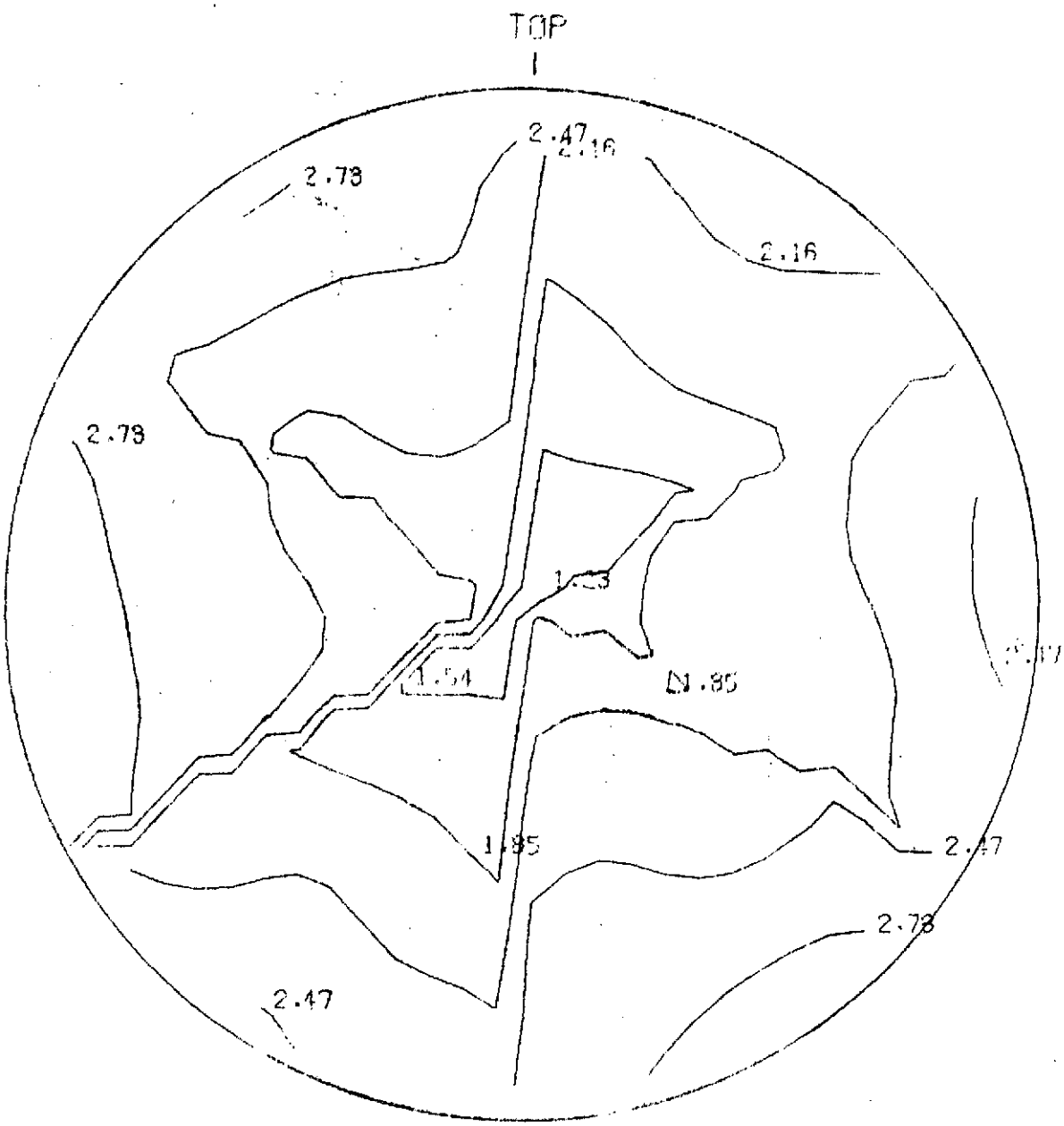


FIGURE 83

Task 2.3A2 - Nominal + Mfg. Error + Third Temperature

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.3327 = 100
TOTAL ENERGY = 0.2461000D+01
MAP REPRESENTS 0.2316395D+01 OR 94.1241 PERCENT OF TOTAL ENERGY

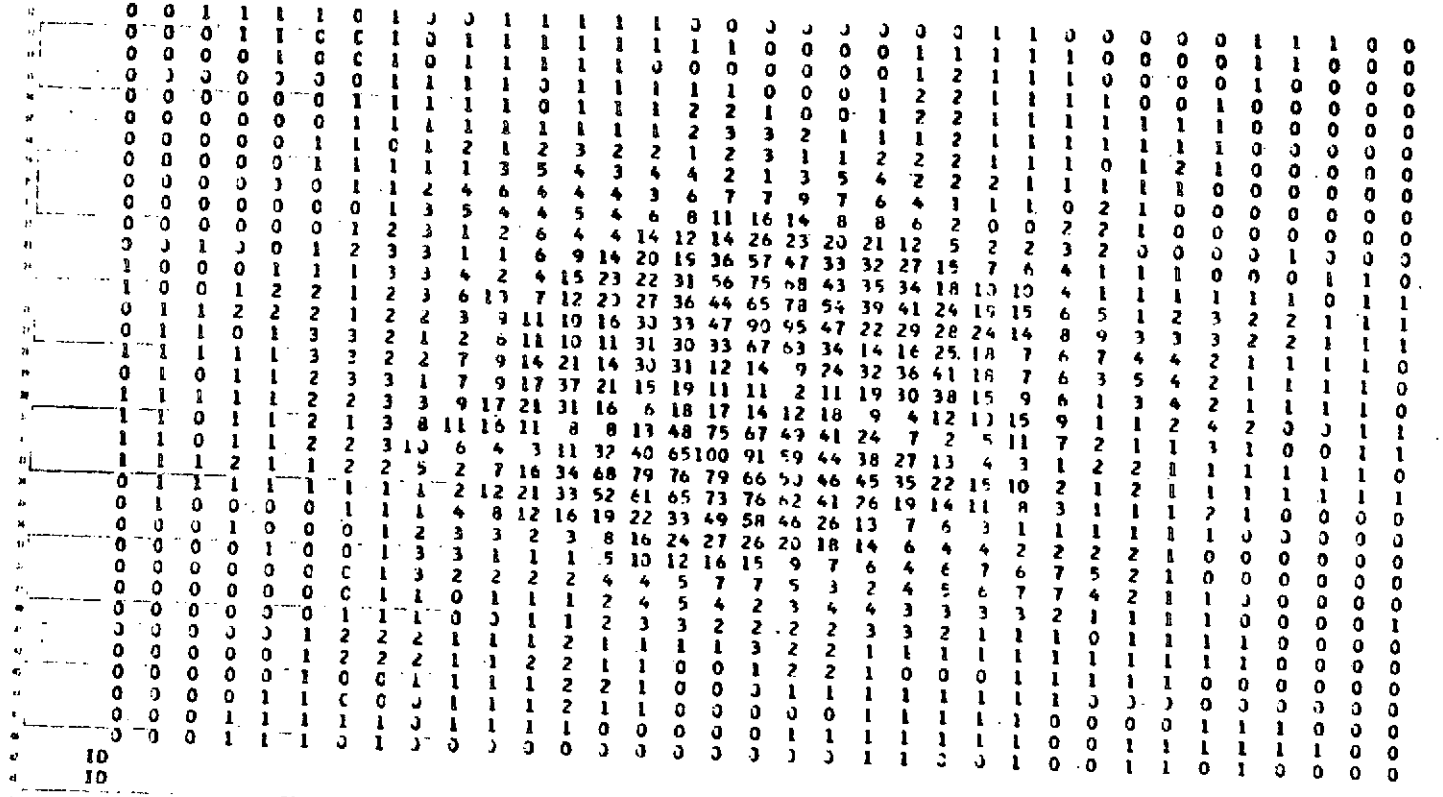


FIGURE 84

Point Spread Function

Task 2.3A2 - Nominal + Mfg. Error + Third Temperature

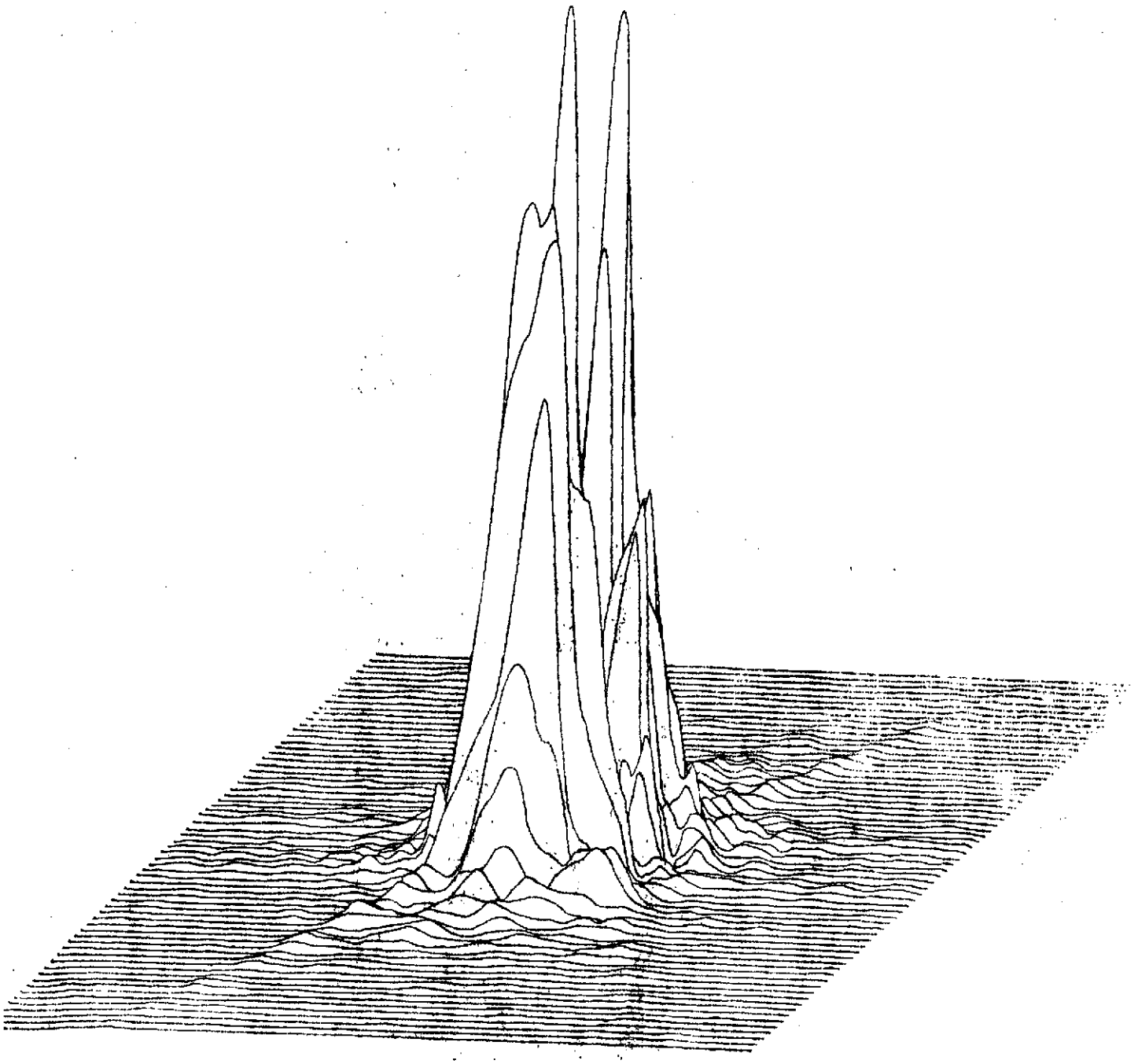


FIGURE 85

Intensity Distriubtion - Central 129 Microradians

Task 2.3A2 - Nominal + Mfg. Error + Third Temperature

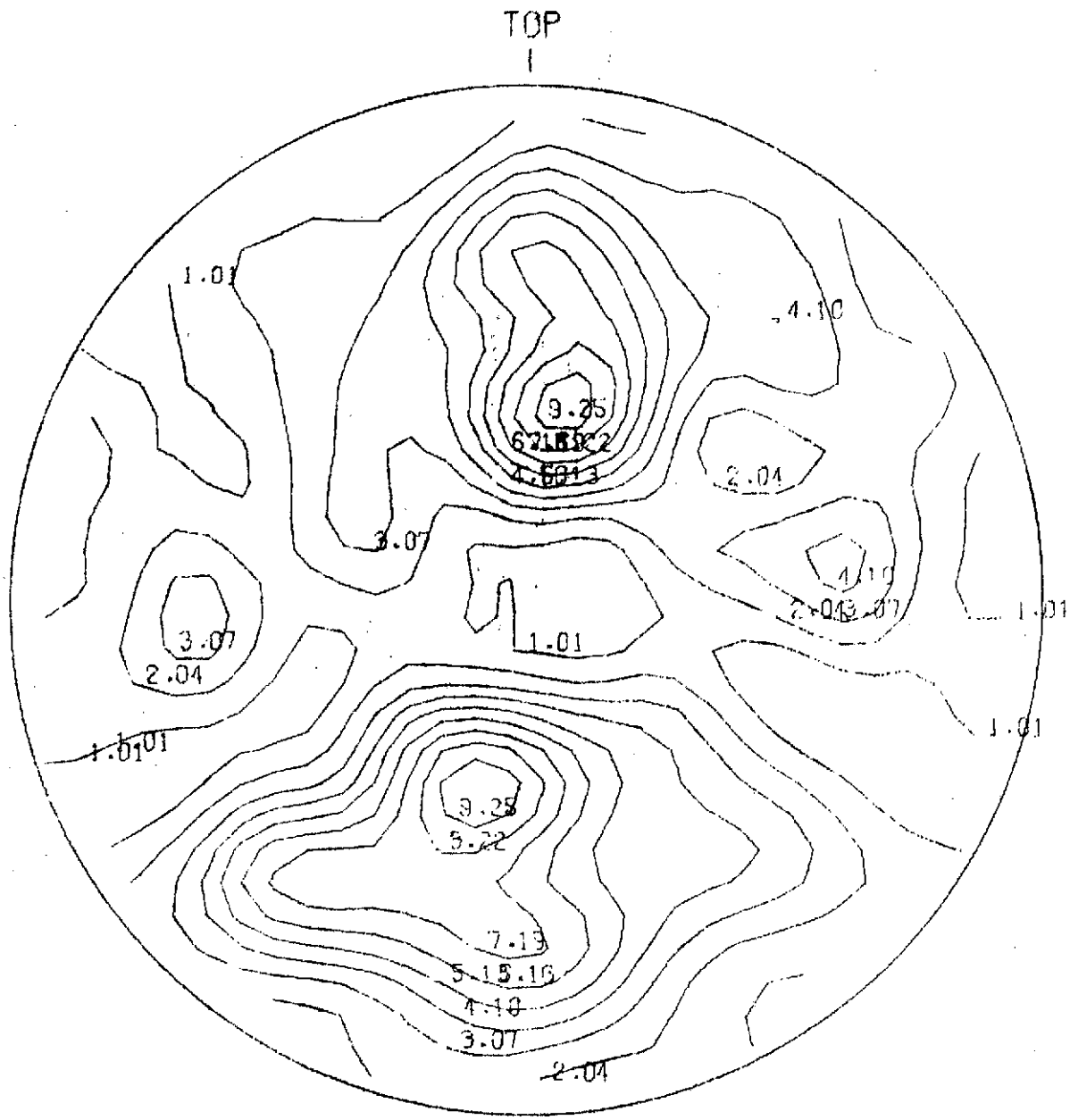


FIGURE 86
Encircled Energy
Vs
Field Angle
Task 2.3A2 - Nominal
+ Mfg. Error + Third Temperature

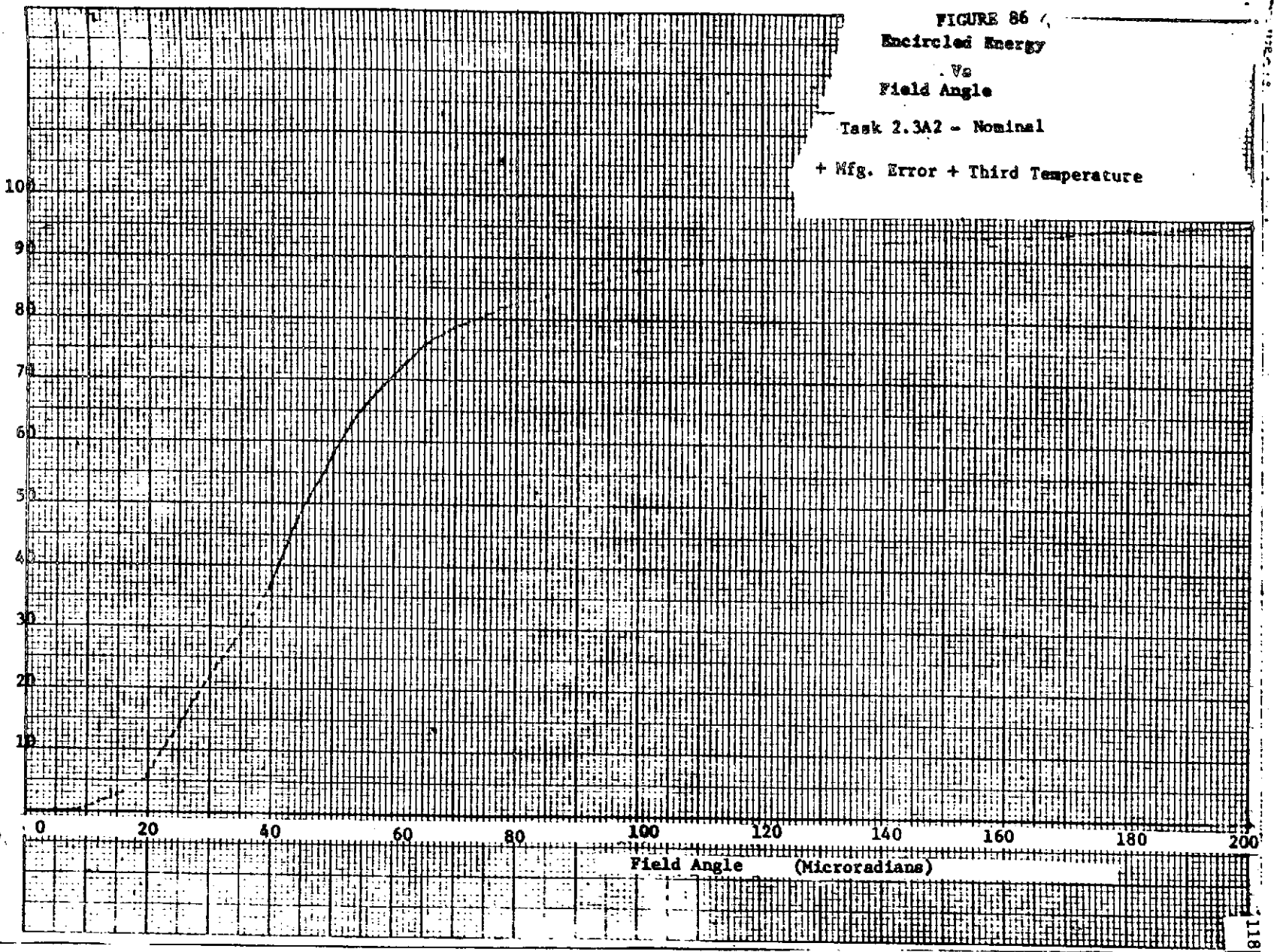


TABLE 20

ENCIRCLED ENERGY

Task 2.5A - Nominal + Mfg. Error + Axial Gradient

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.3	0.1	0.2	0.1	0.3	0.0	0.0
4.00	0.4	0.6	0.5	0.2	0.2	0.1	0.5	1.0	0.6
6.00	0.4	0.6	1.8	0.8	1.6	0.5	1.9	1.0	0.6
8.00	1.6	2.0	3.1	1.5	1.6	1.1	3.4	3.0	2.1
10.00	2.3	2.8	4.3	2.1	3.3	1.6	4.9	4.1	3.0
12.00	5.6	6.4	6.7	3.5	3.8	2.9	7.6	8.3	6.6
14.00	5.6	6.4	8.6	5.9	6.0	5.2	10.5	8.3	6.6
16.00	9.8	10.9	11.5	7.5	7.3	7.0	13.8	13.1	11.1
18.00	11.6	12.7	13.5	10.5	13.2	10.1	16.3	15.1	13.2
20.00	15.1	16.4	17.4	13.5	13.2	13.3	20.7	18.9	17.0
22.00	16.8	18.0	19.7	18.2	21.2	18.2	23.2	20.7	19.1
24.00	20.9	22.2	22.8	20.4	23.8	20.6	26.2	24.9	23.4
26.00	22.9	24.1	25.7	26.1	31.6	26.4	28.8	27.0	25.9
28.00	27.4	28.8	30.4	31.5	33.4	31.9	33.7	31.4	30.2
30.00	30.6	31.9	33.3	36.4	40.2	36.8	35.7	34.9	33.9
32.00	36.6	38.0	38.0	40.0	42.5	40.4	40.4	40.5	39.5
34.00	37.7	39.2	41.3	45.3	47.0	45.6	43.4	41.9	40.6
36.00	44.0	45.4	46.3	48.6	50.1	48.7	48.5	47.5	46.2
38.00	46.4	48.0	49.6	52.2	54.2	52.2	51.0	50.1	48.6
40.00	51.2	52.3	53.7	55.1	56.2	55.0	55.4	54.0	53.0
42.00	53.3	54.5	56.8	58.6	60.5	58.5	58.4	56.1	54.9
44.00	57.7	58.2	59.8	60.5	62.6	60.1	61.4	59.5	59.0
46.00	60.0	60.2	62.2	63.8	66.5	63.4	63.7	61.4	61.3
48.00	63.4	63.0	65.0	66.2	67.3	65.7	66.4	64.3	64.6
50.00	65.6	65.0	66.6	68.0	70.4	67.7	67.8	66.2	66.8
52.00	68.4	67.1	69.0	70.2	71.6	69.9	69.9	68.1	69.3
54.00	69.9	68.5	70.6	71.9	73.4	71.8	71.3	69.4	70.6
56.00	72.3	70.8	73.0	73.7	74.4	73.7	73.2	71.4	72.7
58.00	73.9	72.5	74.2	74.8	75.8	74.8	74.2	72.9	74.0
60.00	75.5	74.1	75.8	76.1	76.8	76.2	75.7	74.3	75.4
62.00	76.5	75.3	76.8	77.1	77.7	77.2	76.8	75.4	76.3
64.00	77.9	76.9	77.9	77.9	78.5	78.1	77.7	77.0	77.7
66.00	78.7	78.0	78.9	79.0	79.4	79.0	78.8	78.0	78.5
68.00	79.7	79.1	79.7	79.7	80.0	79.7	79.6	79.1	79.7
70.00	80.3	79.9	80.6	80.6	80.8	80.5	80.6	79.9	80.3
72.00	81.2	80.9	81.2	81.4	81.5	81.3	81.3	81.0	81.4
74.00	81.7	81.5	82.0	82.1	82.3	82.0	82.1	81.5	81.9
76.00	82.5	82.4	82.6	82.8	82.9	82.8	82.9	82.4	82.7
78.00	83.1	83.0	83.2	83.4	83.7	83.3	83.4	83.1	83.3
80.00	83.7	83.7	83.8	84.0	84.3	84.1	84.1	83.7	83.9

TABLE 21

ENCIRCLED ENERGY

Task 2.5A - Nominal + Mfg. Error + Axial Gradient

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.4	0.6	1.3	0.7	0.9	0.4	1.5	1.0	0.6
10.00	2.3	2.8	4.3	2.1	3.3	1.6	4.9	4.1	3.0
15.00	8.0	9.2	10.9	6.5	7.3	6.1	12.8	11.2	9.2
20.00	15.1	16.4	17.4	13.5	13.2	13.3	20.7	18.9	17.0
25.00	22.2	23.6	24.8	25.7	27.9	25.9	28.1	26.3	25.0
30.00	30.6	31.9	33.3	36.4	40.2	36.8	35.7	34.9	33.9
35.00	41.8	43.1	44.2	46.2	49.2	46.4	45.9	45.0	44.0
40.00	51.2	52.3	53.7	55.1	56.2	55.0	55.4	54.0	53.0
45.00	59.1	59.5	61.0	62.7	64.9	62.3	62.7	60.9	60.4
50.00	65.6	65.0	66.6	68.0	70.4	67.7	67.8	66.2	66.8
55.00	71.5	69.9	72.0	73.0	74.2	72.8	72.4	70.5	71.9
60.00	75.5	74.1	75.8	76.1	76.8	76.2	75.7	74.3	75.4
65.00	78.3	77.4	78.5	78.5	79.1	78.6	78.4	77.4	78.1
70.00	80.3	79.9	80.6	80.6	80.8	80.5	80.6	79.9	80.3
75.00	82.2	82.0	82.3	82.5	82.6	82.5	82.5	82.1	82.3
80.00	83.7	83.7	83.8	84.0	84.3	84.1	84.1	83.7	83.9
85.00	85.0	85.1	85.4	85.5	85.9	85.7	85.6	85.2	85.2
90.00	86.3	86.5	86.8	86.8	87.1	86.9	86.8	86.5	86.5
95.00	87.6	87.7	87.9	87.8	88.0	87.8	87.8	87.7	87.6
100.00	88.5	88.7	88.7	88.7	88.9	88.7	88.7	88.7	88.5
105.00	89.3	89.4	89.5	89.5	89.6	89.5	89.6	89.4	89.3
110.00	90.0	90.0	90.1	90.1	90.3	90.2	90.2	90.1	90.1
115.00	90.6	90.7	90.7	90.8	90.9	90.8	90.8	90.8	90.7
120.00	91.2	91.2	91.2	91.4	91.4	91.3	91.3	91.3	91.3
125.00	91.7	91.7	91.8	91.8	91.9	91.8	91.8	91.7	91.7
130.00	92.2	92.1	92.2	92.2	92.3	92.2	92.2	92.2	92.2
135.00	92.6	92.6	92.5	92.6	92.6	92.6	92.6	92.6	92.6
140.00	93.0	93.0	93.0	93.0	92.9	93.0	93.0	93.0	92.9
145.00	93.3	93.3	93.4	93.3	93.3	93.3	93.3	93.3	93.3
150.00	93.7	93.6	93.7	93.7	93.7	93.7	93.6	93.6	93.6
155.00	94.0	94.0	94.0	94.0	94.1	94.0	94.0	93.9	94.0
160.00	94.3	94.3	94.3	94.3	94.3	94.3	94.3	94.3	94.3
165.00	94.6	94.5	94.6	94.6	94.6	94.6	94.6	94.6	94.6
170.00	94.8	94.8	94.8	94.9	94.9	94.9	94.9	94.9	94.8
175.00	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1
180.00	95.4	95.4	95.4	95.4	95.4	95.4	95.4	95.4	95.4
184.99	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6
189.99	95.8	95.9	95.9	95.9	95.9	95.9	95.9	95.9	95.9
194.99	96.0	96.0	96.1	96.0	96.2	96.1	96.1	96.1	96.1
199.99	96.3	96.3	96.3	96.3	96.3	96.3	96.3	96.3	96.3

FIGURE 87

Wavefront Map-() Polarization

Task 2.5A - Nominal + Mfg. Error + Axial Gradient

MAP IN UNITS OF 0.01 WAVES


```
                                  118 113 109 106 103 116 118 117 116 118
                              130 125 121 116 112 108 105 101 118 120 119 118 120 124 130 136
                          130 127 122 118 114 111 108 105 101 115 118 118 118 120 125 130 134 136
                      129 126 123 118 114 111 110 108 106 102 109 113 115 116 119 123 127 129 129 127
                  123 124 121 117 113 110 108 108 108 106 102 102 107 110 113 116 120 122 122 121 120 118
              114 117 118 115 111 107 104 105 106 107 106 102  96 101 106 110 114 117 118 117 115 114 113 112
          104 108 111 111 108 103 100 100 101 105 106 104 100  91  97 102 108 112 115 116 114 111 110 109 109 110
      103 100 103 105 104 100  96  93  95  98 102 103 101  97  87  93  99 105 110 112 113 111 109 107 106 106 107 182
  165 165 165 101  99  94  89  88  90  95  99 103  98  93  84  89  94  99 104 106 107 106 105 104 102 177 181 183
  169 168 167 166  95  89  84  82  85  90  95  96  93  88  81  84  87  91  94  97  99 100 101 100 172 179 183 185
175 173 171 168 166 163 160  79  77  79  84  89  90  87  82  77  79  80  81  84  87  90  93 161 167 174 180 185 189 188
183 177 173 168 164 162 159 156 152  73  77  81  82  80  76  72  72  72  72  74  77 154 158 163 169 174 180 187 191 192
185 181 175 168 163 161 160 158 154 151 148  72  73  72  70  66  66  65  64 152 156 159 162 166 173 174 179 186 192 195
190 185 177 169 164 161 161 160 158 154 152 151  66  66  64  59  59  58 150 155 160 163 166 168 170 173 177 184 191 196
194 188 180 172 166 164 164 164 161 158 155 152 148 141  59  50 135 145 152 157 160 164 166 167 167 170 175 183 191 196
196 191 183 175 170 167 167 166 164 160 157 152 145 135  50  59 141 148 152 155 158 161 164 164 164 166 172 181 188 194
196 191 184 177 173 170 168 166 163 160 155 150  58  59  59  64  66  66 151 152 154 158 160 161 161 164 169 177 185 190
195 192 186 179 174 170 166 162 159 156 152  64  65  66  66  70  72  73  72 148 151 154 158 160 161 163 168 175 181 185
192 191 187 180 174 169 163 158 154  77  74  72  72  72  72  76  80  82  81  77  73 152 156 159 162 164 168 173 177 180
188 189 185 180 174 167 161  93  90  87  84  81  80  79  77  82  87  90  89  84  79  77  79 160 163 166 168 171 173 175
    185 183 179 172 100 101 100  99  97  94  91  87  84  81  88  93  96  95  90  85  82  84  89  95 166 167 168 169
    183 181 177 102 104 105 106 107 106 104  99  94  89  84  93  98 100  99  95  90  88  89  94  99 101 165 165 165
    182 107 106 106 107 109 111 113 112 110 105  99  93  87  97 101 103 102  98  95  93  96 100 104 105 103 103 163
        110 109 109 110 111 114 116 115 112 108 102  97  91 100 104 106 105 101 100 100 103 108 111 111 108 104
            112 113 114 115 117 118 117 114 110 106 101  96 102 106 107 106 105 104 107 111 115 118 117 114
                118 120 121 122 122 120 116 113 113 107 102 102 106 108 108 108 110 113 117 121 124 123
                    127 129 129 127 123 119 116 115 113 109 102 106 108 110 111 114 118 123 126 129
                        135 134 130 125 120 118 118 118 115 101 105 108 111 114 118 122 127 130
                            136 130 124 120 118 119 120 118 101 105 108 112 116 121 125 130
                                118 116 117 118 116 103 106 109 113 118
```

FIGURE 88

Wavefront Plot-Q Polarization

Task 2.5A - Nominal + Mfg. Error + Axial Gradient

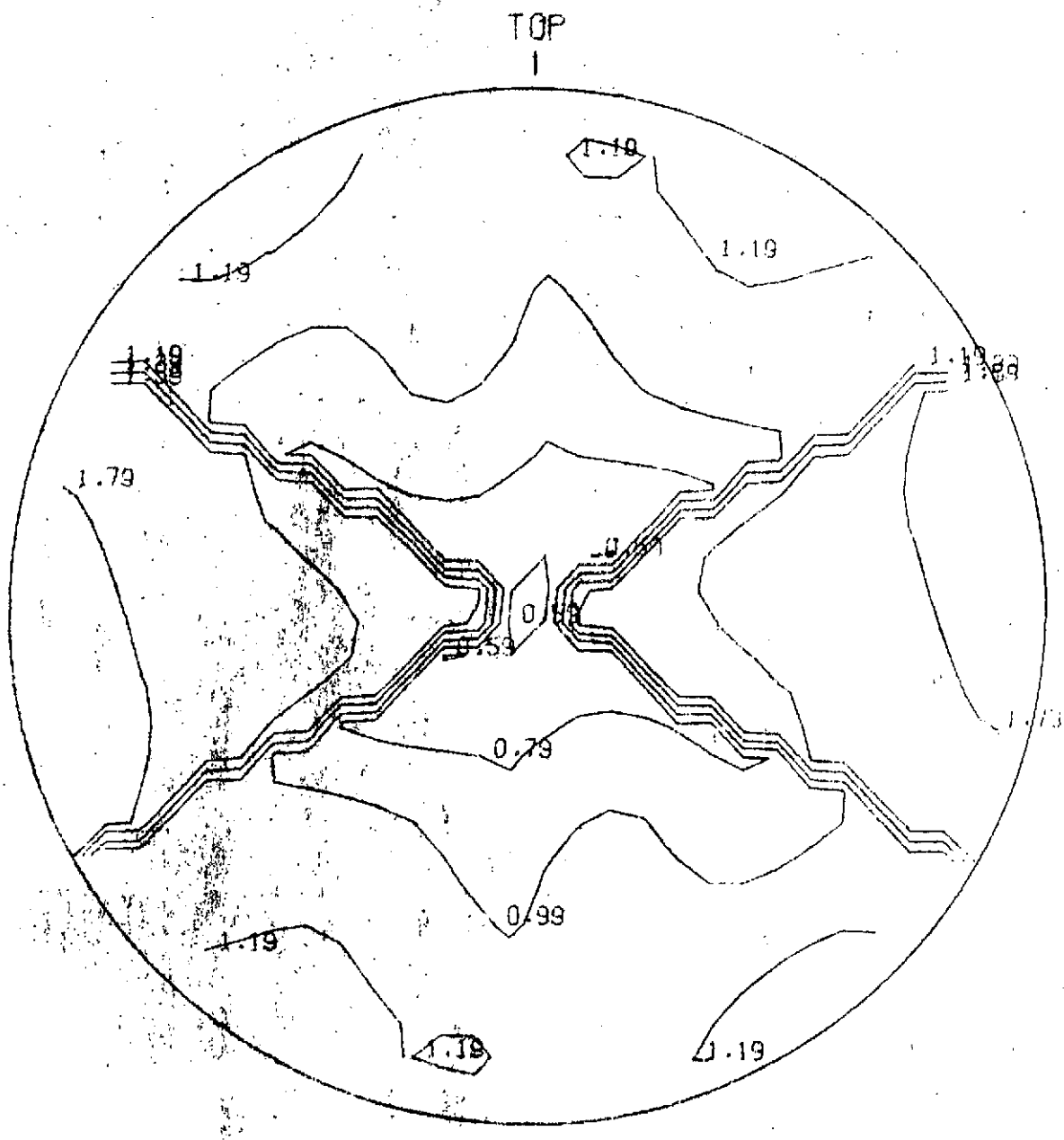


FIGURE 69

Wavefront Map-P Polarization

Task 2.5A - Nominal + Mfg. Error + Axial Gradient

MAP IN UNITS OF 0.01 WAVES

```
                                                176 172 168 165 161 124 126 125 125 126
                                        189 184 179 174 170 167 163 160 126 128 128 127 128 133 139 144
                                    189 185 181 176 172 169 167 163 159 124 126 127 127 129 133 139 143 144
                                187 185 181 177 173 170 168 166 164 160 118 122 123 124 127 131 135 137 137 136
                            182 182 180 176 172 168 167 167 166 165 161 111 116 119 121 124 128 130 131 130 128 126
                        173 176 176 173 169 165 163 164 165 166 164 160 105 110 114 119 122 125 127 126 124 122 121 121
                    163 167 170 170 168 162 158 158 160 163 164 163 159  99 105 111 116 121 124 124 122 120 118 118 118 119
                179 159 162 164 163 159 154 152 153 157 161 162 160 156  96 101 107 113 118 121 121 119 117 115 114 115 115 148
                181 181 181 159 157 153 148 146 148 153 158 159 157 152  93  98 103 108 112 115 115 115 114 112 111 143 147 149
                185 184 183 182 153 147 142 140 143 149 154 155 152 147  89  93  96 100 103 105 107 109 109 109 139 145 149 151
            191 189 187 184 182 179 176 138 135 138 143 147 148 146 141  85  87  88  90  92  95  98 102 127 133 140 146 151 155 154
            196 193 189 184 180 178 175 172 168 132 136 139 140 139 134  80  81  81  80  82  86 120 124 129 135 141 146 153 157 158
            201 197 191 184 179 177 176 174 170 167 164 130 132 131 128  74  74  73  72 118 122 125 128 132 136 140 145 152 158 161
            206 201 193 185 180 177 177 176 174 170 168 167 124 124 123  67  68  66 116 121 126 129 132 134 136 139 143 150 157 162
            210 204 196 188 182 180 180 180 177 174 171 168 164 157 117  59 101 111 118 123 126 130 132 133 133 136 141 149 157 162
            212 207 199 191 186 183 183 182 180 176 173 168 161 151  70 129 107 114 118 121 124 127 130 130 130 132 138 146 154 160
            212 207 200 193 189 186 184 182 179 176 171 166  78  79  79 135 136 136 117 118 120 124 126 127 127 130 135 143 151 156
            211 208 202 195 190 186 182 178 175 172 168  84  85  86  86 140 143 143 142 114 117 120 124 126 127 129 134 141 147 151
            208 207 203 196 190 185 179 174 170  97  94  92  92  92  92 146 150 152 151 147 144 118 122 125 128 130 134 139 143 146
            204 205 201 196 190 183 177 114 110 107 104 101 100  99  97 152 158 160 159 154 149 147 149 126 129 132 134 137 139 141
                231 199 195 188 123 121 120 119 117 114 111 108 104 101 158 164 166 165 160 155 152 154 159 165 132 133 134 135
                199 197 193 123 124 125 127 127 126 124 120 114 109 104 164 168 171 170 165 160 158 159 164 169 171 131 131 131
                198 127 126 126 127 129 131 133 132 130 125 119 113 107 167 172 174 172 169 165 164 166 171 175 176 174 170 129
                    131 129 129 130 132 134 136 135 132 128 123 117 111 170 174 176 175 172 170 170 173 178 181 182 178 174
                    132 133 134 135 137 138 137 134 130 126 122 116 172 176 177 177 175 175 177 181 185 188 188 184
                        138 140 141 142 142 140 136 133 130 127 122 172 176 178 178 178 180 183 187 191 194 193
                        148 149 149 147 143 139 136 135 133 129 172 176 178 180 182 184 189 193 197 199
                            156 154 150 145 140 138 138 138 135 171 175 178 181 184 188 192 197 201
                                156 151 144 140 138 139 140 138 171 175 178 182 186 191 196 200
                                        138 136 137 138 136 173 177 180 183 188
```

AVERAGE AVERAGE AVERAGE AXIAL GR

RMS 0.30 PK-PK 1.54

FIGURE 90

Wavefront Plot-P Polarization

Task 2.5A - Nominal + Mfg. Error + Axial Gradient

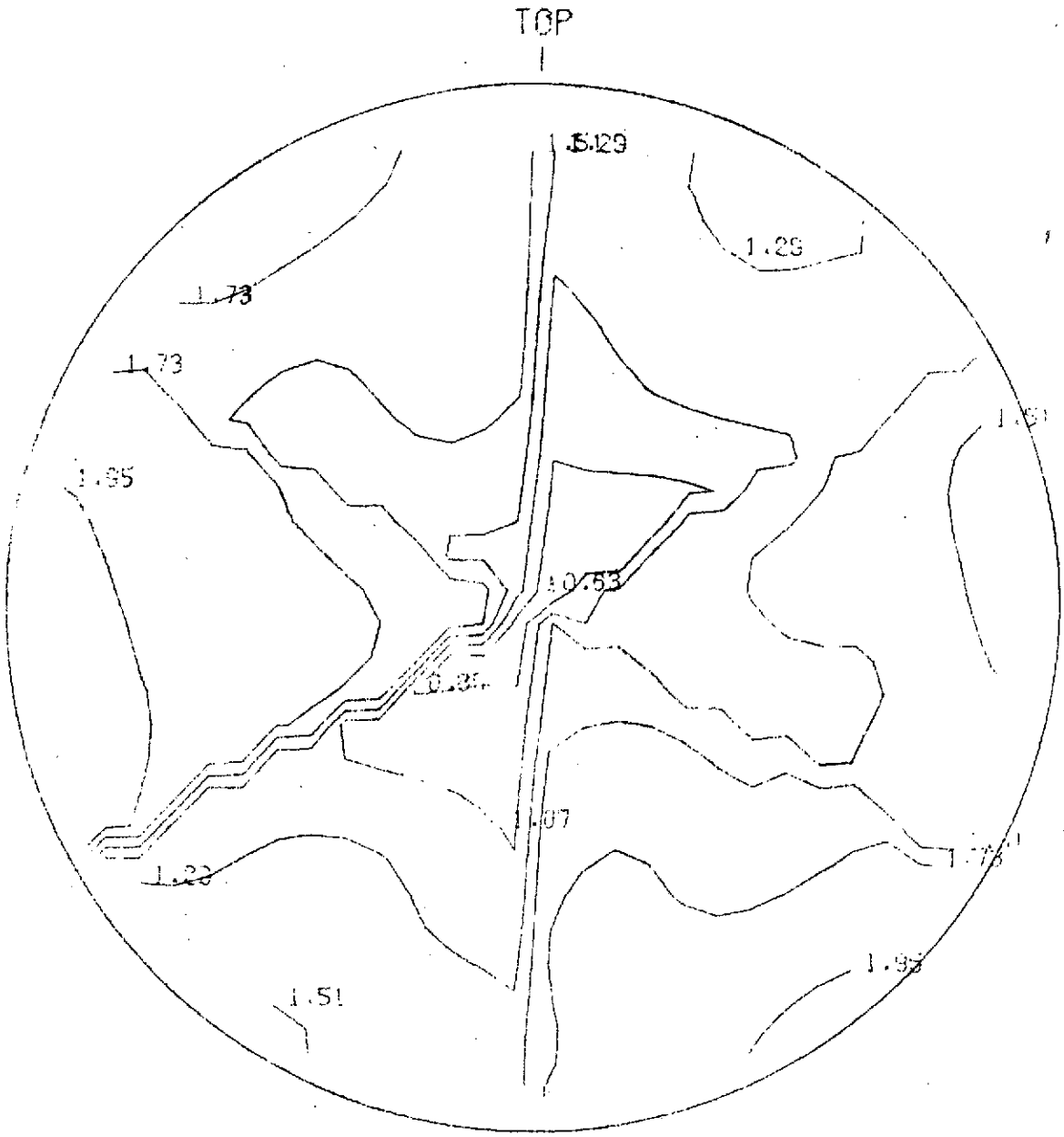


FIGURE 91

Task 2.5A – Nominal + Mfg. Error + Axial Gradient

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0620 = 100
TOTAL ENERGY = 0.2461000D+01
MAP REPRESENTS 0.2316924D+01 OR 94.1456 PERCENT OF TOTAL ENERGY

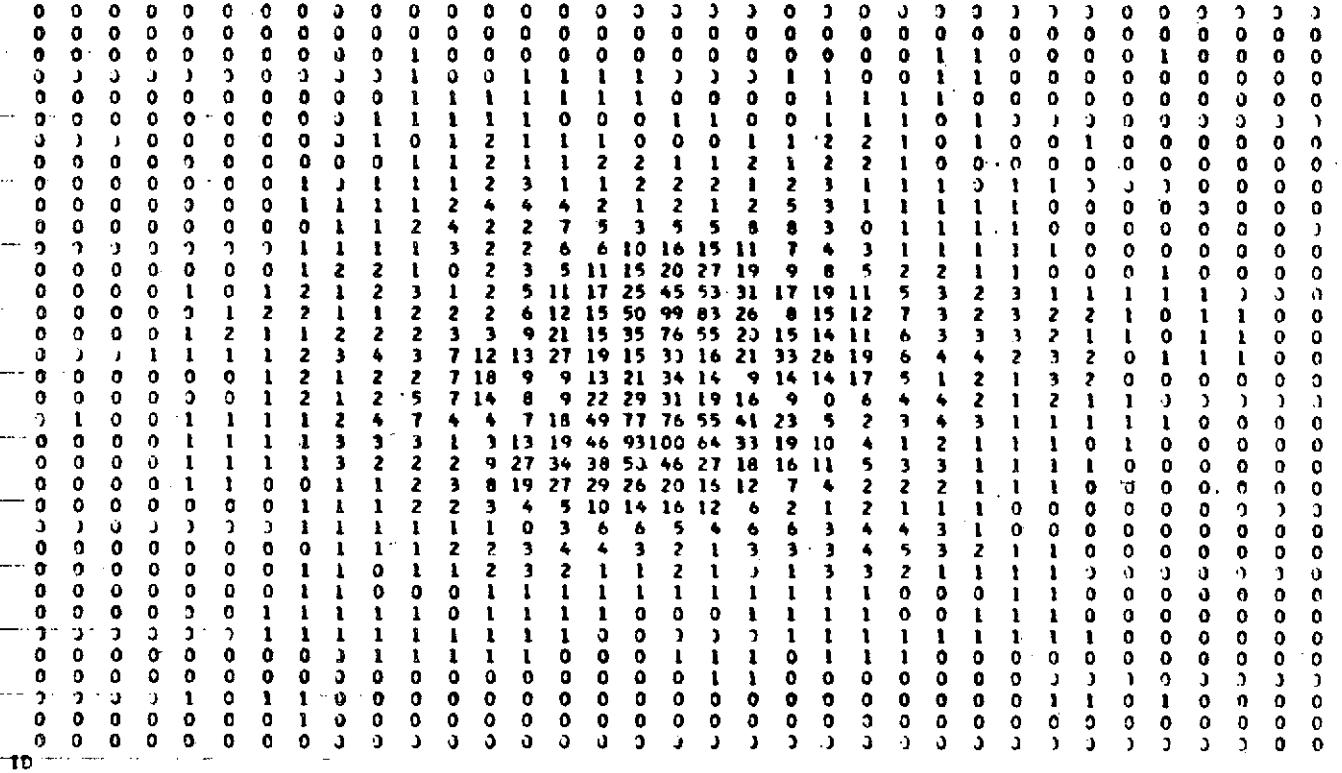


FIGURE 92

Point Spread Function

Mask 2.5A - Nominal + Mfg. Error + Axial Gradient

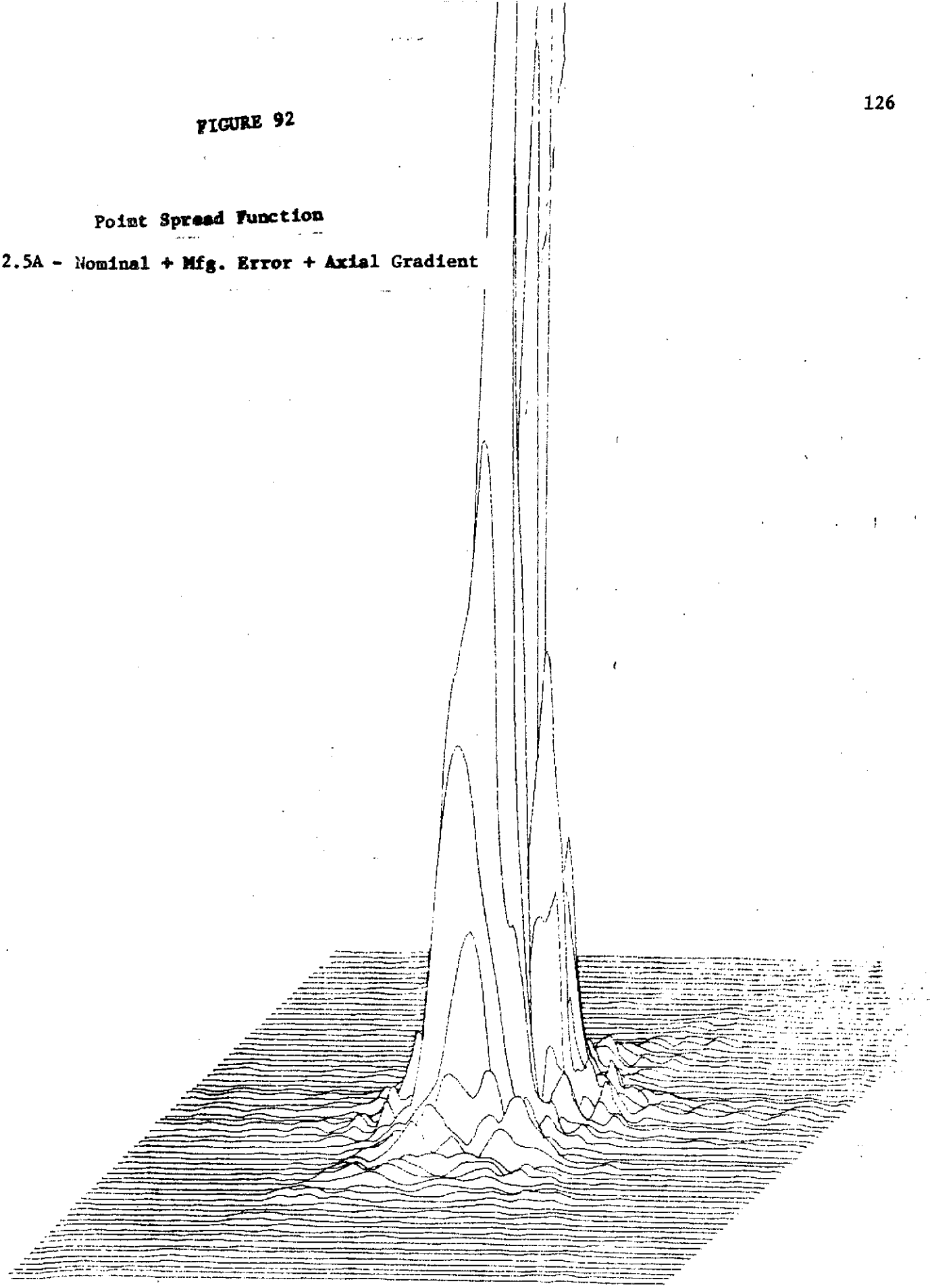
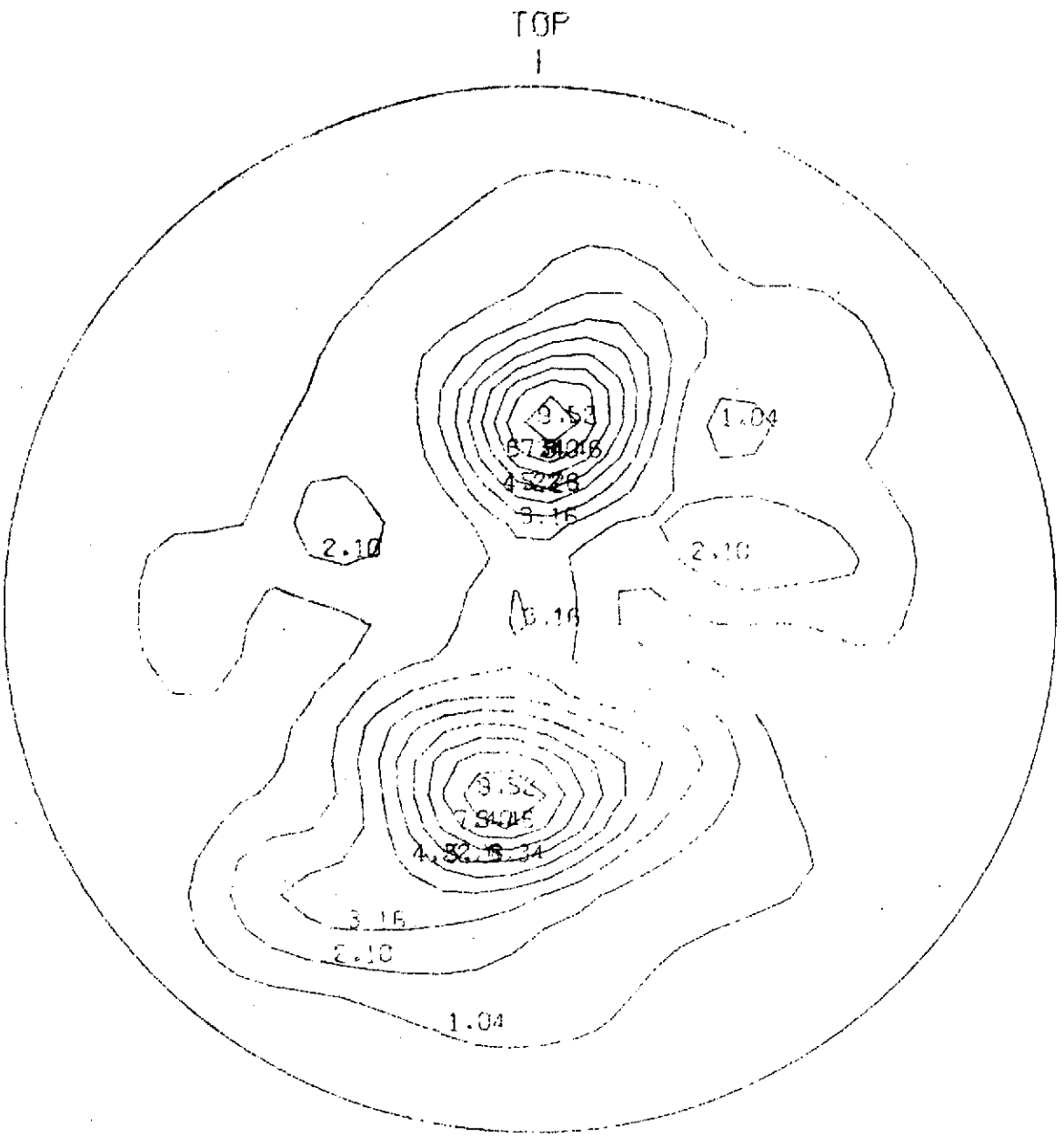


FIGURE 93

Intensity Distribution - Central 120 Microradians

Track 2.5A - Nominal + Mfg. Error + Axial Gradient



REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

FIGURE 94

Encircled Energy

. Vs

Field Angle

Task 2.5A - Nominal

+ Mfg. Error + Axial Gradient

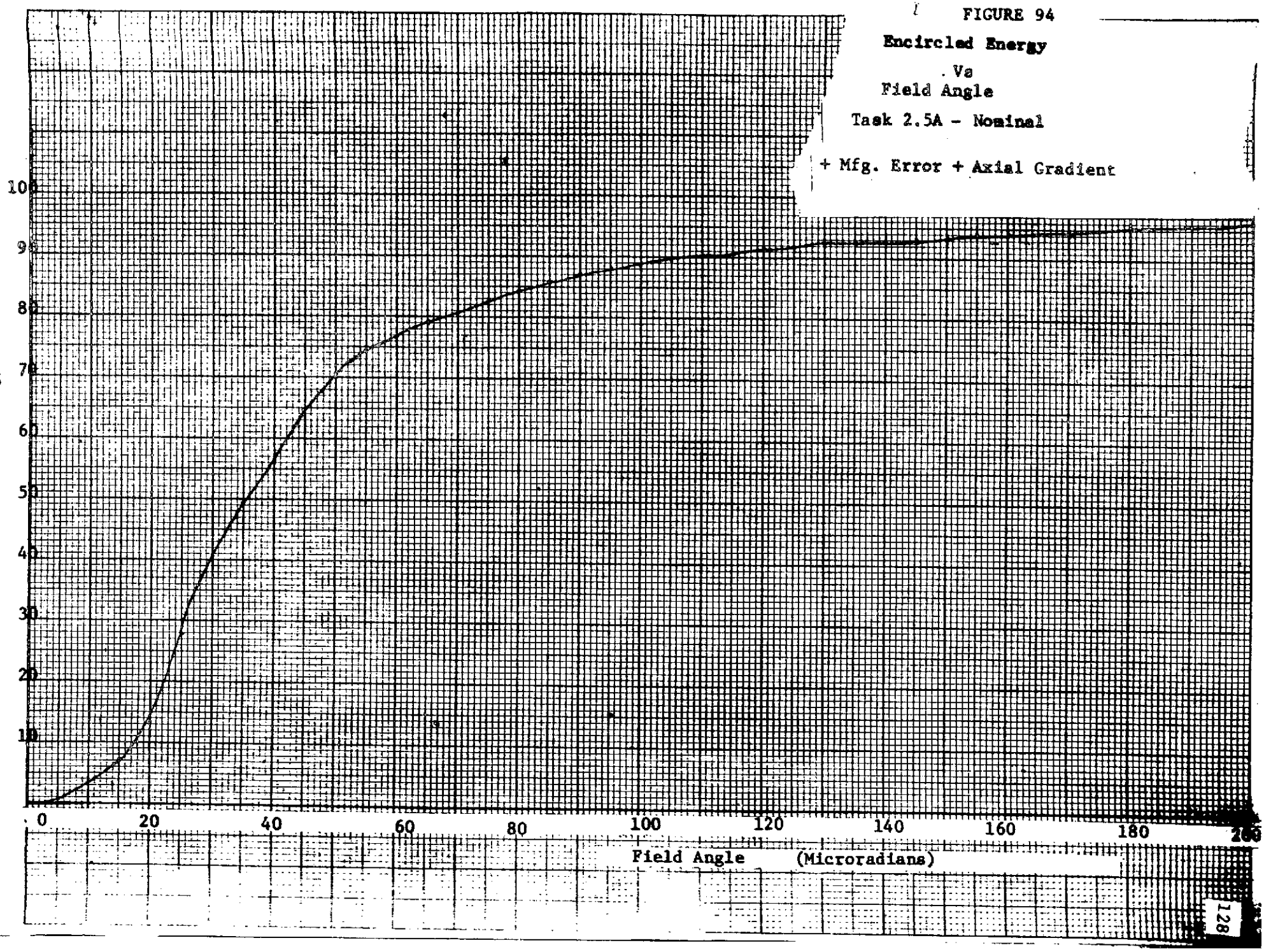


TABLE 22

ENCIRCLED ENERGY

Task 2.5B - Nominal + Mfg. Error + Radial Gradient

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.00	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
6.00	0.1	0.0	0.1	0.1	0.3	0.1	0.2	0.1	0.1
8.00	0.2	0.1	0.3	0.2	0.3	0.2	0.3	0.2	0.2
10.00	0.3	0.1	0.3	0.3	0.6	0.3	0.4	0.2	0.3
12.00	0.6	0.3	0.5	0.4	0.6	0.4	0.6	0.5	0.6
14.00	0.6	0.3	0.7	0.6	0.8	0.6	0.8	0.5	0.6
16.00	0.9	0.6	0.9	0.8	0.9	0.8	1.0	0.8	0.9
18.00	1.1	0.7	1.0	1.0	1.2	0.9	1.2	0.9	1.1
20.00	1.4	1.1	1.4	1.2	1.2	1.2	1.5	1.2	1.4
22.00	1.6	1.3	1.6	1.5	1.5	1.4	1.7	1.4	1.6
24.00	2.1	1.8	1.9	1.7	1.6	1.6	2.0	1.9	2.1
26.00	2.4	2.1	2.2	2.0	1.9	1.9	2.2	2.2	2.4
28.00	3.1	2.8	2.8	2.4	2.0	2.3	2.8	2.9	3.1
30.00	3.5	3.3	3.2	2.9	2.6	2.8	3.2	3.4	3.5
32.00	4.4	4.4	3.8	3.2	2.9	3.1	3.8	4.4	4.4
34.00	4.7	4.7	4.5	4.0	3.7	4.0	4.5	4.7	4.7
36.00	5.8	6.0	5.4	4.6	4.4	4.5	5.5	6.2	5.9
38.00	6.4	6.7	6.3	5.6	5.6	5.6	6.5	7.0	6.6
40.00	7.8	8.4	7.6	6.5	6.2	6.5	7.9	8.9	8.2
42.00	8.5	9.1	9.1	8.1	8.0	8.1	9.5	9.7	8.9
44.00	10.5	11.3	10.5	9.3	9.0	9.2	11.0	12.1	11.1
46.00	12.0	12.9	12.2	11.6	11.3	11.5	13.0	13.9	12.7
48.00	14.2	15.2	14.6	13.6	12.3	13.5	15.6	16.4	15.0
50.00	16.2	17.2	16.2	15.8	15.3	15.6	17.6	18.7	17.2
52.00	19.0	20.0	18.6	18.2	17.2	17.9	20.1	21.6	20.1
54.00	20.5	21.6	20.9	21.1	21.2	20.9	22.7	23.3	21.6
56.00	23.6	24.6	24.3	24.2	23.6	23.9	26.1	26.3	24.8
58.00	26.1	27.0	26.9	26.9	27.9	26.6	28.6	28.8	27.4
60.00	29.3	30.2	30.2	30.3	31.2	30.0	31.9	32.0	30.7
62.00	31.5	32.3	33.6	34.2	34.9	33.9	35.1	33.9	32.8
64.00	35.9	36.5	36.4	37.2	38.2	36.9	37.7	38.0	37.1
66.00	38.5	39.1	40.0	41.5	42.0	41.2	41.2	40.5	39.7
68.00	42.6	43.0	43.2	44.2	44.3	44.0	44.2	44.2	43.6
70.00	45.2	45.6	46.6	47.9	48.2	47.7	47.5	46.7	46.1
72.00	49.1	49.3	49.3	50.7	51.8	50.6	50.1	50.1	49.9
74.00	51.2	51.3	53.0	53.9	55.3	53.9	53.6	52.1	51.9
76.00	54.7	54.7	56.0	56.6	58.0	56.6	56.6	55.2	55.3
78.00	57.2	57.0	58.4	58.8	61.2	58.9	59.0	57.4	57.8
80.00	59.9	59.6	61.2	61.7	63.4	61.8	61.7	59.9	60.4

TABLE 23

ENCIRCLED ENERGY

Task 2.5B - Nominal + Mfg. Error + Radial Gradient

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.1	0.0	0.1	0.1	0.2	0.1	0.2	0.1	0.1
10.00	0.3	0.1	0.3	0.3	0.6	0.3	0.4	0.2	0.3
15.00	0.8	0.5	0.8	0.7	0.9	0.7	1.0	0.7	0.8
20.00	1.4	1.1	1.4	1.2	1.2	1.2	1.5	1.2	1.4
25.00	2.3	2.0	2.1	2.0	1.8	1.8	2.1	2.1	2.3
30.00	3.5	3.3	3.2	2.9	2.6	2.8	3.2	3.4	3.5
35.00	5.3	5.5	4.9	4.1	4.2	4.1	5.0	5.6	5.4
40.00	7.8	8.4	7.6	6.5	6.2	6.5	7.9	8.9	8.2
45.00	11.3	12.1	11.3	10.7	10.3	10.6	12.1	13.1	11.9
50.00	16.2	17.2	16.2	15.8	15.3	15.6	17.6	18.7	17.2
55.00	22.5	23.6	22.7	22.6	22.9	22.3	24.4	25.2	23.8
60.00	29.3	30.2	30.2	30.3	31.2	30.0	31.9	32.0	30.7
65.00	37.1	37.7	38.6	39.6	40.5	39.3	39.8	39.1	38.3
70.00	45.2	45.6	46.6	47.9	48.2	47.7	47.5	46.7	46.1
75.00	53.2	53.3	54.4	55.4	56.7	55.4	55.0	53.9	53.8
80.00	59.9	59.6	61.2	61.7	63.4	61.8	61.7	59.9	60.4
85.00	65.8	65.1	67.2	67.7	69.0	67.8	67.3	65.2	66.2
90.00	71.1	70.1	71.6	72.1	73.0	72.2	71.5	70.1	71.2
95.00	75.3	74.3	75.2	75.6	76.1	75.7	75.1	74.2	75.2
100.00	78.3	77.4	78.2	78.5	78.8	78.5	78.3	77.4	78.4
105.00	80.6	80.0	80.7	81.0	81.3	81.0	80.9	80.2	80.9
110.00	82.7	82.5	82.9	83.1	83.6	83.2	83.1	82.7	83.0
115.00	84.6	84.8	84.8	85.0	85.4	85.1	85.0	84.8	84.8
120.00	86.3	86.5	86.7	86.8	87.1	86.8	86.7	86.5	86.4
125.00	87.6	87.9	88.2	88.1	88.5	88.1	88.1	87.9	87.6
130.00	88.9	89.1	89.4	89.2	89.6	89.2	89.3	89.1	88.8
135.00	90.1	89.9	90.1	90.1	90.3	90.0	90.1	89.9	90.1
140.00	90.9	90.8	91.0	91.0	91.0	91.0	91.0	90.8	90.8
145.00	91.6	91.5	91.6	91.6	91.5	91.6	91.5	91.4	91.6
150.00	92.2	92.1	92.3	92.2	92.3	92.2	92.2	92.1	92.1
155.00	92.7	92.7	92.8	92.7	93.0	92.7	92.8	92.7	92.7
160.00	93.2	93.3	93.3	93.3	93.4	93.3	93.3	93.3	93.2
165.00	93.7	93.7	93.8	93.8	93.8	93.8	93.8	93.7	93.7
170.00	94.1	94.0	94.1	94.1	94.2	94.1	94.2	94.1	94.1
175.00	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.5
180.00	94.8	94.8	94.8	94.8	94.8	94.9	94.8	94.8	94.8
184.99	95.1	95.2	95.1	95.1	95.1	95.1	95.1	95.1	95.1
189.99	95.4	95.4	95.5	95.5	95.5	95.5	95.5	95.4	95.4
194.99	95.7	95.7	95.7	95.7	95.8	95.7	95.8	95.7	95.7
199.99	96.0	96.0	96.0	96.1	96.1	96.1	96.1	96.1	96.1

FIGURE 93

Wavefront Map-η Polarization

Task 2.5B - Nominal + Mfg. Error + Radial Gradient

MAP IN UNITS OF 0.01 WAVES

```
                                                  122 113 106 100  95 108 111 113 116 122
                                              141 130 119 109 100  93  87  82  98 101 104 107 113 123 135 147
                                          137 126 115 104  95  87  81  75  70  84  88  91  95 101 111 123 133 142
                                      131 121 110  99  89  81  76  71  66  61  68  74  77  82  89  98 108 116 124 130
                                  123 116 105  94  84  75  69  65  61  57  52  52  58  64  69  76  85  93  99 105 112 118
                              113 108 100  89  78  68  61  57  54  52  49  45  39  45  51  58  65  73  80  85  90  95 103 111
                          103  99  93  84  73  62  53  48  45  45  44  41  36  27  33  40  48  56  63  69  73  77  83  91 100 109
                      165  91  87  79  70  59  48  39  36  36  36  35  32  27  17  23  30  39  47  54  59  63  67  72  80  89 109 184
                  163 152 142  68  58  46  35  28  25  26  28  27  23  18   9  14  21  28  35  42  47  52  57  63  70 154 169 181
                  163 151 139 128  49  36  25  17  16  18  19  18  15   9   1   5  10  15  21  28  35  41  48  54 135 150 166 179
          178 164 150 136 124 113 103  17   9   7   8  10   9   5   0  -5  -2   0   2   7  14  22  31 104 117 132 148 164 180 191
          181 166 149 134 120 139 100  91  81  -1  -1   0  -1  -4  -9 -13 -12 -11  -9  -4   2  83  92 103 116 130 146 163 180 193
          185 168 149 131 117 106  98  90  81  73  68 -11 -12 -14 -18 -22 -21 -20 -19  71  78  86  94 104 115 128 143 161 179 195
          189 170 150 132 116 105  97  91  83  75  70  66 -21 -23 -25 -31 -30 -29  65  73  81  88  96 104 113 125 139 157 177 195
          192 173 153 134 118 107 100  93  85  78  72  66  59  50 -32 -40  45  56  66  74  80  88  95 102 110 121 137 155 176 194
          194 176 155 137 121 110 102  95  88  80  74  66  56  45 -40 -32  59  59  66  72  78  85  93 100 107 118 134 153 173 192
          195 177 157 139 125 113 106  96  88  81  73  65 -29 -30 -31 -25 -23 -21  66  70  75  83  91  97 105 115 132 150 170 189
          195 179 160 143 128 115 104  94  86  78  71 -19 -20 -21 -22 -18 -14 -12 -11  68  73  81  90  98 106 117 131 149 168 185
          193 180 163 146 130 116 133  92  83   2  -4  -9 -11 -12 -13  -9  -4  -1   3  -1  -1  81  91 100 109 120 134 149 166 181
          191 180 164 148 132 117 104  31  22  14   7   2   0  -2  -5   0   5   9  10   8   7   9  17 103 113 124 136 150 164 178
              179 166 150 135  54  48  41  35  28  21  15  10   5   1   9  15  18  19  18  16  17  25  36  49 128 139 151 163
              181 169 154  70  63  57  52  47  42  35  28  21  14   9  18  23  27  28  26  25  28  35  46  58  68 142 152 163
              184 130  89  80  72  67  63  59  54  47  39  30  23  17  27  32  35  36  36  36  39  48  59  72  79  87  93 165
                  109 100  91  83  77  73  69  63  56  48  40  33  27  36  41  44  45  45  48  53  62  73  84  93  99 103
                      111 103  95  90  85  80  73  65  58  51  45  39  45  49  52  54  57  61  68  78  89 100 108 113
                          118 112 105  99  93  85  76  69  64  58  52  52  57  61  65  69  75  84  94 105 116 123
                              133 124 116 108  98  89  82  77  74  68  61  66  71  76  81  89  99 110 121 131
                                  142 133 123 111 101  95  91  88  84  70  75  81  87  95 104 115 126 137
                                      147 135 123 113 107 104 101  98  82  87  93 100 139 119 130 141
                                          122 116 113 111 108  95 100 106 113 122
```

FIGURE 96

Wavefront Plot-Q Polarization

Task 2.5B - Nominal + Mfg. Error + Radial Gradient

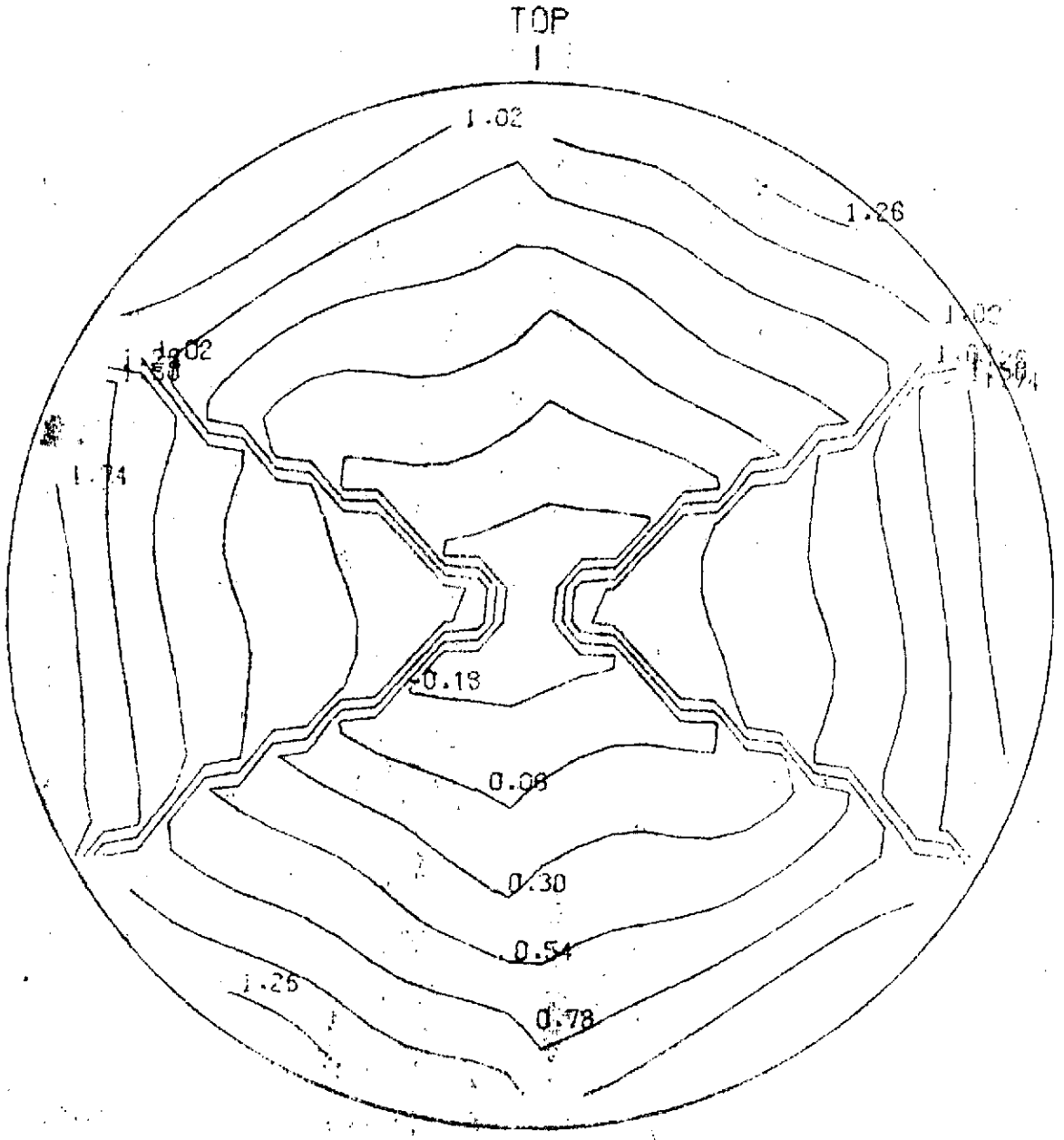


FIGURE 97

Wavefront Map-P Polarization

Task 2.5B - Nominal + Mfg. Error + Radial Gradient

133

MAP IN UNITS OF 0.01 WAVES

```
                                                181 172 164 158 154 117 120 122 125 131
                                            200 188 177 167 159 151 145 140 107 110 112 115 121 131 143 155
                                        195 184 173 163 154 146 140 134 128  93  97 100 103 110 120 131 142 151
                                    190 180 169 158 148 140 134 129 124 119  77  82  86  90  97 107 116 125 132 138
                                181 174 164 153 142 134 127 123 120 116 111  41  67  72  78  85  93 101 108 114 120 126
                            171 166 158 148 136 127 119 115 113 111 108 103  47  53  59  66  74  82  88  93  98 104 111 119
                        162 157 151 143 132 121 112 106 104 104 102  99  95  35  42  49  57  65  72  77  82  86  91  99 108 117
                    181 152 145 138 128 117 106  98  96  94  94  94  91  86  26  32  39  47  55  62  67  71  75  81  88  98 108 150
                179 168 158 127 117 104  93  86  84  85  86  85  82  76  17  23  29  36  44  50  56  61  66  71  78 120 135 147
                179 167 155 144 108  95  83  76  74  76  78  77  73  67  10  14  18  24  30  36  43  50  56  63 101 116 132 145
            194 180 156 152 140 129 119  75  68  65  66  68  68  64  58   2   5   8  11  16  23  31  40  70  83  98 114 131 146 157
            197 182 165 150 136 125 116 107  97  57  57  58  57  53  48  -5  -3  -2   3   3  10  49  58  69  82  96 112 129 146 159
            201 184 165 147 133 122 114 106  97  89  84  47  46  43  40 -13 -12 -12 -10  37  44  52  60  70  81  94 109 126 145 161
            205 186 166 148 132 121 113 107  99  91  86  82  36  34  32 -22 -21 -21  31  39  47  54  62  70  79  91 105 124 143 161
            208 189 169 150 134 123 116 109 101  94  88  82  75  66  26 -32  11  22  32  40  47  54  61  68  76  87 103 121 142 160
            210 192 171 153 137 126 118 111 104  96  90  82  72  61 -20  38  16  25  32  38  44  51  59  66  73  84 100 119 139 158
            211 193 173 155 141 129 120 112 104  97  89  81  -9 -10 -11  44  46  48  32  36  42  49  57  63  71  82  98 116 136 155
            211 195 176 159 144 131 120 110 102  94  87   0   0  -1  -2  51  55  57  58  34  39  47  56  64  72  83  97 115 134 151
            209 195 179 162 146 132 119 108  99  22  15  11   9   7   6  60  65  68  69  68  68  47  57  66  75  86 100 115 132 147
            207 196 180 164 148 133 120  51  42  34  27  22  19  17  14  69  75  79  80  78  77  79  87  69  79  90 102 116 130 144
                195 182 166 151  75  68  61  55  48  41  35  30  26  22  79  85  89  90  88  86  88  95 106 119  94 105 117 129
                197 185 170  90  83  77  72  67  62  55  48  41  34  29  88  94  97  98  96  95  98 105 116 128 138 108 118 129
                200 120 109 100  92  87  83  79  74  67  59  51  44  38  98 102 105 106 106 106 110 118 129 140 149 157 163 131
                    129 120 111 103  97  93  89  83  76  68  60  53  47 106 111 114 115 116 118 123 133 143 154 163 169 174
                        131 123 116 113 105 100  93  85  78  71  65  59 115 119 122 124 127 131 138 148 159 170 178 183
                            138 132 125 120 113 105  97  89  84  79  72 123 127 132 135 139 145 154 165 176 186 193
                                153 144 137 128 118 109 102  97  94  88 131 136 141 146 152 160 170 181 191 201
                                    162 153 143 131 121 115 111 108 104 140 145 151 158 165 174 185 196 207
                                        167 155 143 133 127 124 122 118 152 157 163 170 179 189 203 211
                                            143 136 133 131 128 165 170 176 183 193
```

FIGURE 98

Wavefront Plot-P Polarization

Task 2.5B - Nominal + Mfg. Error + Radial Gradient

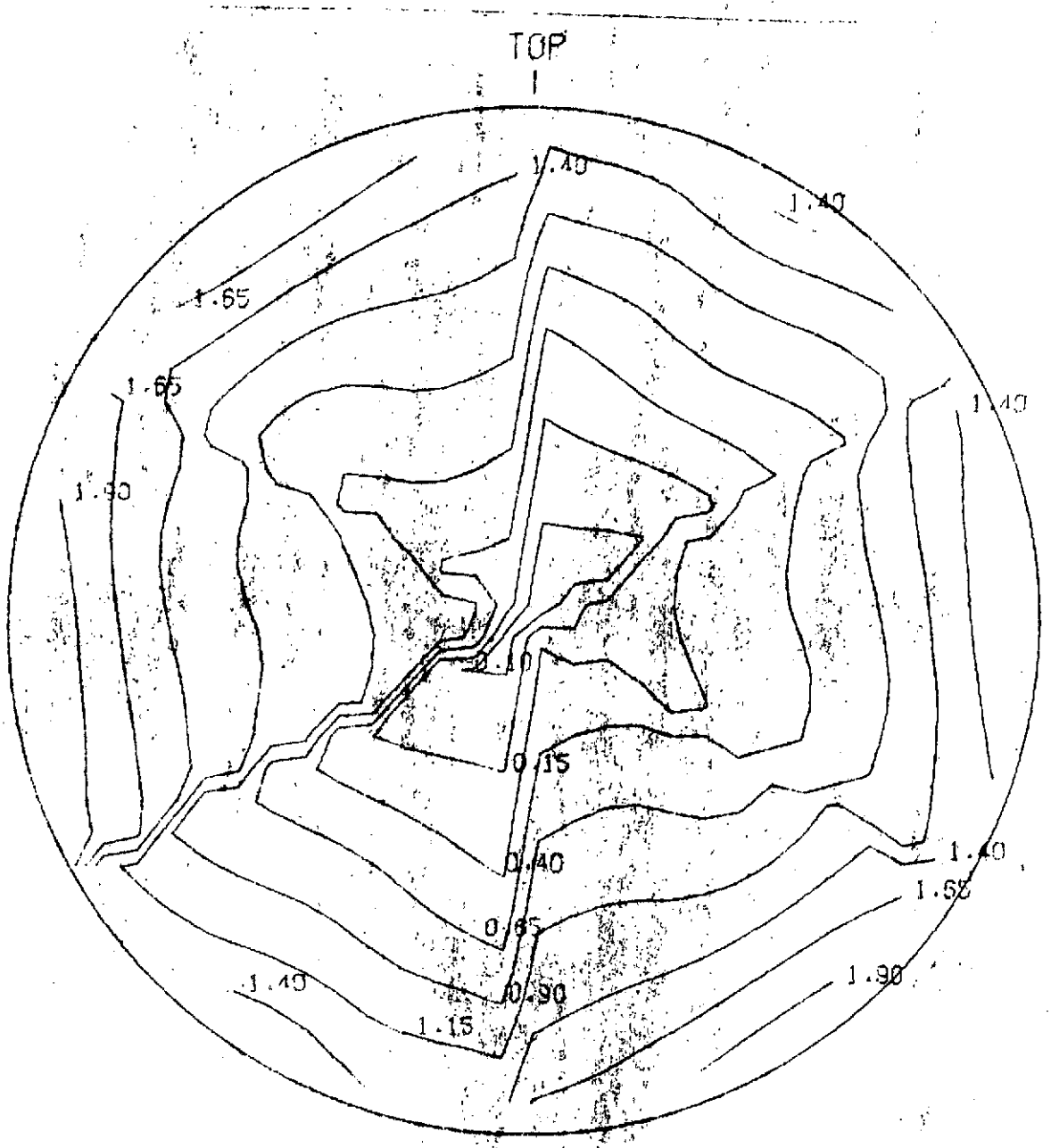


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FIGURE 90

Task 2.5B - Nominal + Mfg. Error + Radial Gradient

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0181 = 100
TOTAL ENERGY = 0.2461[illegible]D+01
MAP REPRESENTS 0.2285451D+01 OR 92.8668 PERCENT OF TOTAL ENERGY

```
 0  0  1  0  0  1  1  2  2  1  1  0  0  0  1  2  1  2  1  1  2  2  1  1  1  1  2  2  1  1  0  0  1  0  0
 1  0  0  0  1  1  2  2  2  2  1  0  0  0  1  2  1  2  1  1  3  3  1  1  2  2  1  2  2  1  1  0  1  1  1
 1  1  1  1  1  1  2  3  3  3  3  2  2  1  2  2  2  3  2  1  2  2  2  2  2  2  1  1  1  1  1  1  1  1  1
 0  .  1  1  1  1  2  3  4  6  7  5  2  1  2  4  6  7  5  2  1  0  1  3  3  3  1  1  1  1  1  2  1  0  0
 1  1  1  0  1  0  1  3  6  9 10  8  6  3  1  3  5  6  4  1  1  2  5  6  5  3  1  0  0  1  1  1  1  1  1
 1  1  1  1  1  1  2  4  7 12 13 12 12  7  3  4  5  5  4  5  6  7 10 10  6  4  2  0  0  0  1  1  1  1  0
 0  0  1  1  1  2  3  5  9 14 14 15 15 11  9  7  7  9  6 11 17 16 18 15  7  3  2  0  0  1  1  1  1  1  0
 1  0  0  1  2  3  3  5 10 12 14 19 21 22 21 14 13 15 11 18 30 30 28 25 13  3  2  1  1  1  1  1  0  0  0
 1  0  1  2  1  2  3  4  5  8 14 20 27 34 31 26 20 18 19 32 51 53 41 32 18  5  1  1  2  1  1  1  1  1  0
 0  1  2  3  3  3  3  2  1  6 12 24 44 53 50 44 32 26 35 54 76 79 61 42 22  9  3  2  2  1  1  2  1  2  1
 1  1  1  2  5  6  4  2  0  3 11 32 50 57 67 65 45 39 53 75 84 74 61 45 25  9  3  2  3  2  1  1  0  1  2
 2  0  1  3  5  7  5  3  1  3 14 30 36 46 67 58 36 33 44 67 75 60 48 39 24 11  4  3  3  3  2  1  1  1  1
 1  1  2  2  2  5  6  5  3  4 10 19 26 40 50 39 31 34 33 39 49 43 34 29 20 13  9  6  4  1  3  3  2  2  0
 1  1  1  0  0  3  5  4  4  3  3  8 14 21 25 27 28 27 22 18 20 16 19 25 17 17 15  9  9  3  6  5  2  2  1
 0  0  0  1  2  4  3  4 11 10  7  8  9 11 12 18 18 10  5  4  4  6 19 30 24 27 23 13 15 10  9  7  4  4  2
 1  0  2  5  5  6  5  9 18 21 23 14  9  9  6  7 12 10  2  1  0  7 18 27 31 33 32 22 18 13 12 12  9  7  3
 2  2  4 10 10 11 10 16 22 27 35 16  6  8  2  3 11 15  5  2  1 12 15 17 30 31 33 28 17 13 13 14 11  8  4
 3  6  8 13 13 13 13 21 25 24 31 16 10 13  3  3 12 21 12  2  4 17 14 16 28 24 27 21 13 12 11 11  8  6  4
 3  8 10 12 13 12 16 22 30 23 28 24 15 11  2  4  8 16 13  6  6 11 11 23 31 21 22 12  7  9  6  7  3  2  2
 2  6  7  9  7 10 18 19 31 27 24 27 15  6  3  6  9 12 11  4  3  5  6 16 20 19 21  9  4  3  2  4  1  0  0
 1  4  3  6  6  8 17 14 22 22 15 22 16  9  7  4  6 12 15 12  9  7  3  4  4  9 12  7  5  3  1  1  0  0  0
 1  2  1  3  5  4 11  7  7 10 10 23 26 24 23 19 18 25 30 30 27 19 11  6  1  1  2  2  5  5  2  1  0  0  1
 1  2  2  1  2  1  3  2  3 10 19 34 50 59 55 42 32 33 38 48 56 48 30 15  6  4  3  1  2  3  2  3  2  1  1
 1  2  3  1  1  1  2  3  6 16 32 53 73 94 97 75 46 34 44 71 86 72 49 27 14  8  6  3  1  1  2  4  3  1  2
 2  1  1  1  1  2  5  5  6 12 29 55 77 95100 81 56 40 47 68 77 68 53 31 11  3  2  3  4  4  2  1  1  1  1
 2  2  0  1  1  2  5  4  2  6 20 47 69 79 72 51 33 26 32 45 53 55 45 26 10  3  1  4  6  5  3  1  1  0  1
 0  1  1  1  1  2  2  1  0  4 15 32 47 55 49 35 22 17 23 31 39 39 31 21 13  8  5  6  6  4  3  3  1  0  1
 0  0  0  1  1  1  1  1  2  4 12 21 25 28 27 19 15 14 14 16 21 22 21 19 16 14 12  8  5  3  2  1  0  1  1
 1  1  1  0  0  0  0  1  3  6 10 16 18 17 14  8  6  9  6  5  9 12 16 19 19 17 11  6  3  1  1  0  0  0  0
 0  0  0  1  1  1  0  0  2  6  8 12 11  8  7  5  4  5  5  4  4  6 11 14 14 12  7  3  1  0  0  1  1  0  0
 0  1  1  1  2  2  1  0  1  3  5  6  5  2  1  3  5  6  5  3  2  3  7  8  9  7  5  2  1  1  1  1  2  1  1
 0  1  1  2  2  2  2  1  1  2  3  3  1  1  0  2  6  7  6  3  1  1  2  4  5  5  3  3  2  2  1  1  1  1  1
 1  0  1  1  1  1  2  2  2  2  2  1  1  1  1  2  3  3  3  2  1  0  1  2  2  3  4  4  3  1  1  1  0  0  0
 1  0  0  0  0  1  1  2  2  2  2  1  1  2  3  3  2  2  1  2  1  0  0  0  1  2  2  2  1  1  0  0  0  0  1
 1  1  1  1  0  1  1  1  1  2  2  1  1  2  2  1  1  2  1  1  1  1  0  0  1  1  2  1  1  0  0  0  1  1  1
ID
ID
```

FIGURE 100

Point Spread Function

Task 2.5B - Nominal + Mfg. Error + Radial Gradient

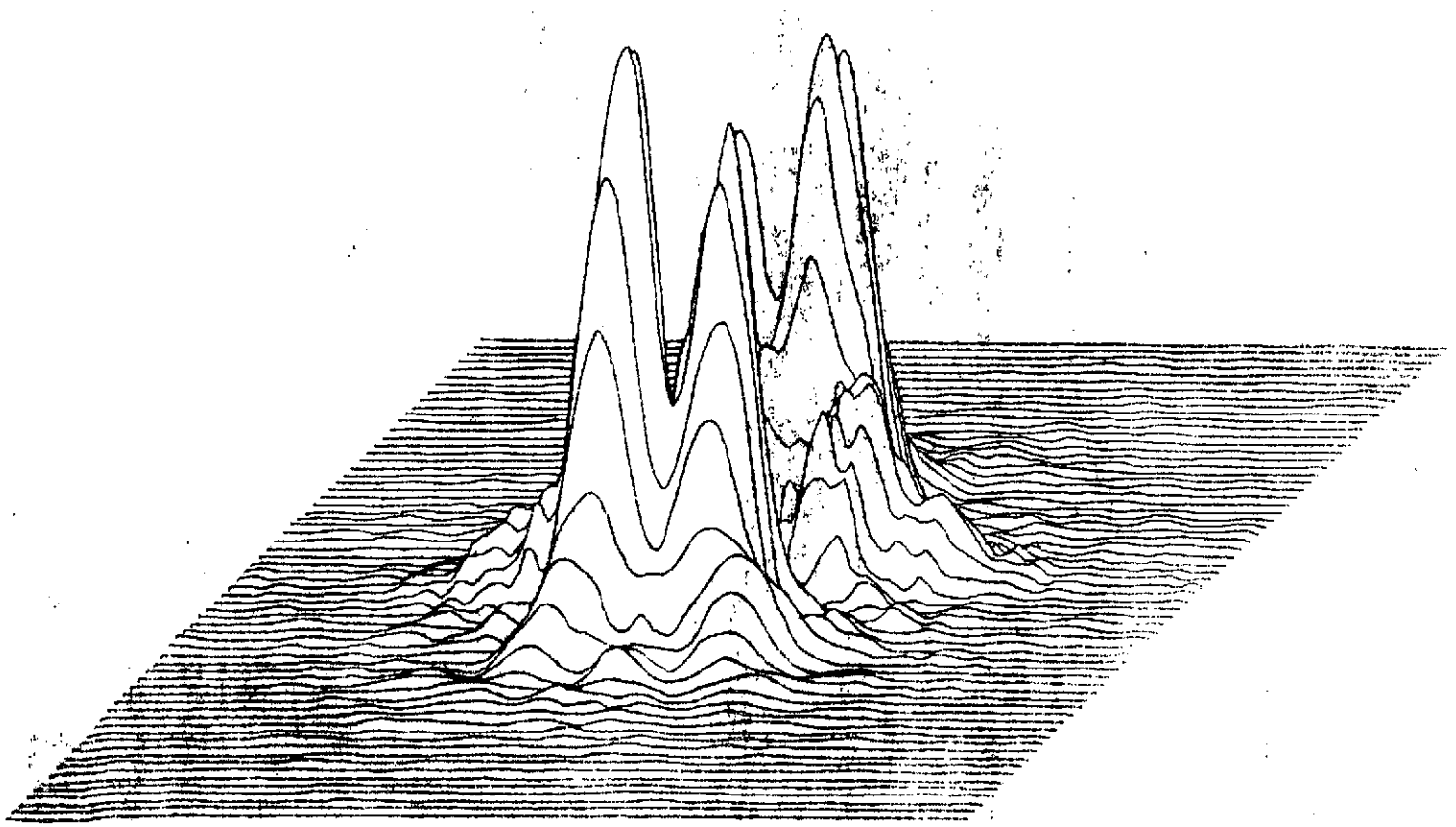

FIGURE 101

Intensity Distriubtion - Central 129 Microradians

Task 2.5B - Nominal + Mfg. Error + Radial Gradient

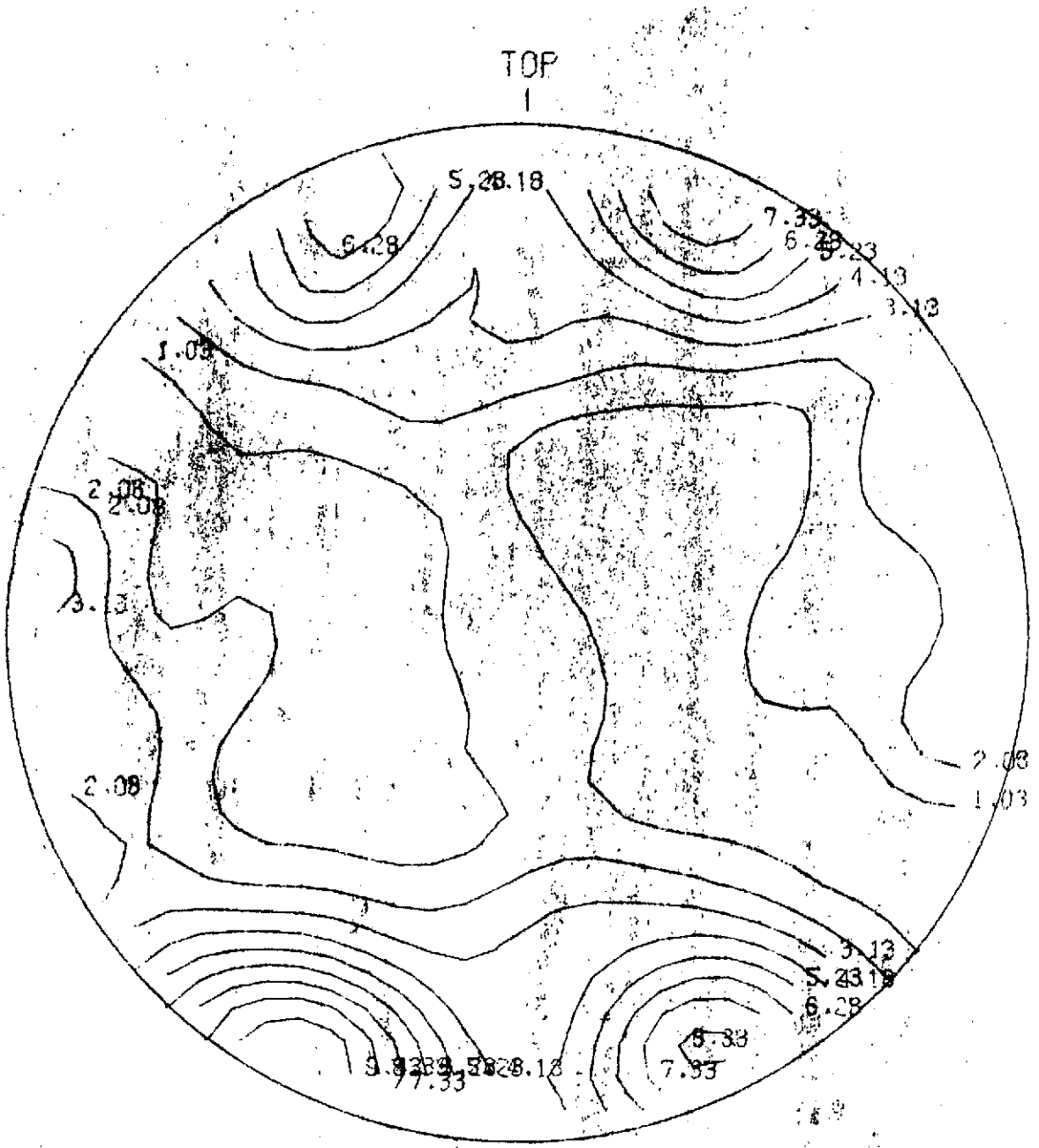

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FIGURE 102

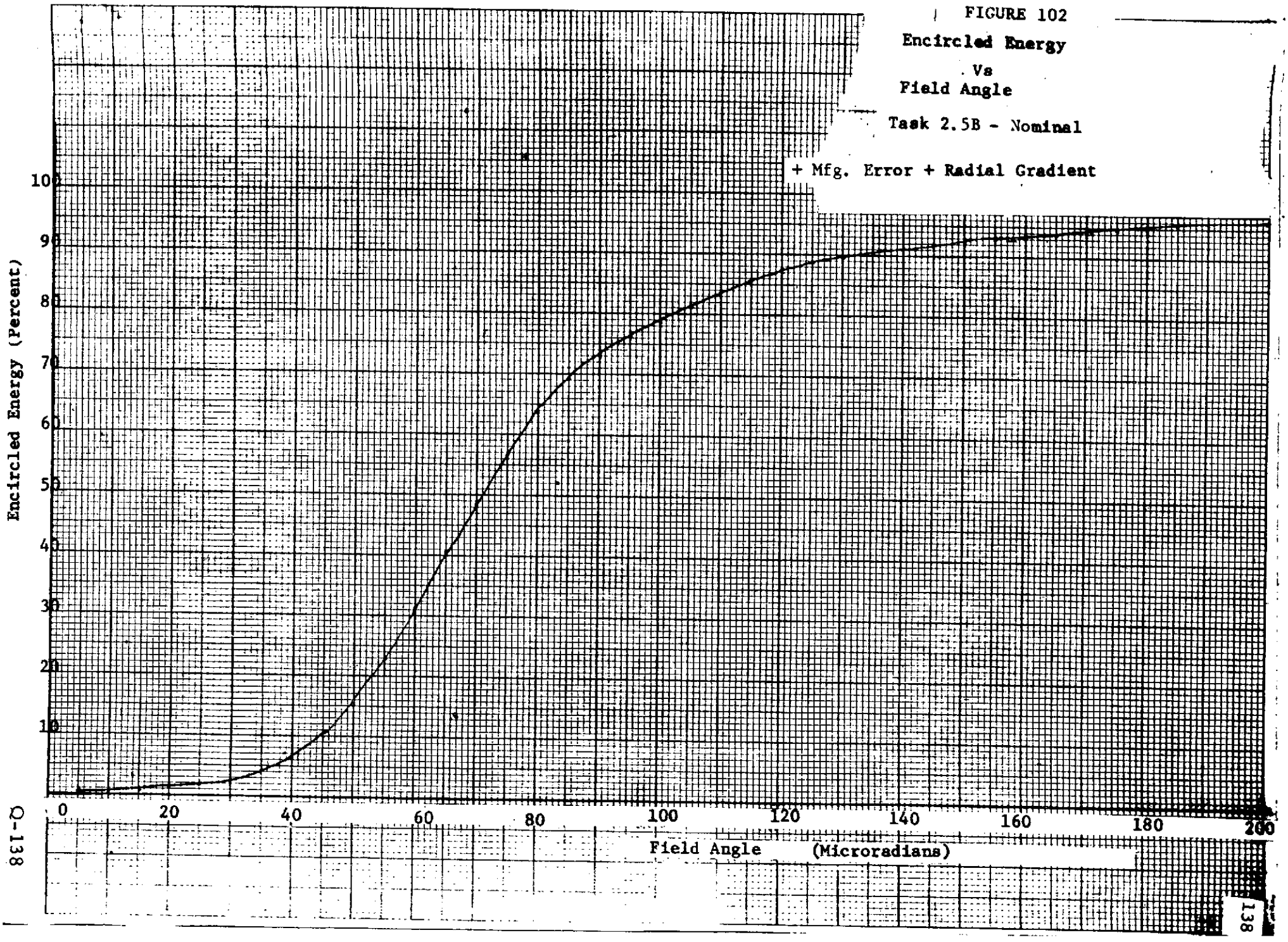
Encircled Energy

Vs

Field Angle

Task 2.5B - Nominal

+ Mfg. Error + Radial Gradient



OFF NOMINAL CUBE

The cube was then analyzed with the three dihedral angles of the cube having different dihedral angles as shown in Figure 8. The off nominal cube was then analyzed with manufacturing error (Task 2.4A of Table 7) and also with manufacturing error and the temperature distribution of Figure 46. (Task 2.4B2 of Table 7).

SUMMARY

The major parameter of interest in this study was the percent energy between 32 and 42 microradians. Table 32 gives the percent energy in this region for all of the analyzed cases. The energy in that ring stayed between 20.0 and 22.0 percent in all of the on-axis cases except for the unit gradient cases. The axial gradient effect shifted the spread of the far field pattern in the opposite direction from the dihedral angle effect and the annulus in the far field pattern narrowed such that the percent energy dropped in the 32-42 microradian ring. The assumed temperature profiles, however, had little effect on the encircled energy. The accuracy with which the encircled energy was determined is ~1.1% (cf. Table 33). The Itek proprietory computer codes used in the analysis are listed in Table 34. Appendix B gives the effect of a variation in the dihedral angle (the angle between the faces). Appendix C provides the viewgraphs which were used in the 4 September PDR briefing in which Itek participated.

TABLE 24

ENCIRCLED ENERGY

Task 2.4A - Off Nominal Cube + Mfg. Error-On Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0
4.00	0.2	0.3	0.1	0.1	0.0	0.0	0.1	0.3	0.2
6.00	0.2	0.3	0.5	0.3	0.1	0.1	0.5	0.3	0.2
8.00	0.8	0.9	0.8	0.4	0.1	0.2	0.9	0.9	0.7
10.00	1.1	1.2	1.3	0.7	0.4	0.4	1.4	1.3	1.0
12.00	2.3	2.6	2.0	1.0	0.6	0.7	2.2	2.8	2.0
14.00	2.3	2.6	3.0	1.8	1.3	1.5	3.2	2.8	2.0
16.00	3.8	4.4	4.0	2.2	1.8	2.0	4.3	4.6	3.5
18.00	4.5	5.0	5.1	3.4	4.2	3.2	5.3	5.4	4.3
20.00	6.1	6.9	7.0	4.4	4.2	4.3	7.3	7.4	6.0
22.00	6.8	7.6	8.3	6.3	7.4	6.3	8.6	8.3	6.9
24.00	9.0	10.1	10.1	7.4	8.6	7.5	10.5	10.9	9.4
26.00	10.2	11.2	11.7	10.1	11.9	10.2	12.2	12.3	10.9
28.00	13.2	14.7	14.8	12.9	12.8	13.0	15.9	15.9	14.3
30.00	15.2	16.7	16.5	15.9	16.6	16.0	17.6	18.3	16.7
32.00	19.4	21.2	19.7	18.2	18.2	18.3	21.3	22.8	21.1
34.00	20.2	22.2	22.0	22.5	22.0	22.6	24.2	23.9	22.1
36.00	24.7	26.9	25.5	25.0	25.2	25.1	28.2	28.7	26.7
38.00	26.7	29.0	28.4	29.0	30.3	29.1	31.1	31.1	29.1
40.00	30.8	32.9	32.0	32.1	32.8	32.1	35.0	35.1	33.2
42.00	32.6	34.8	35.6	36.9	39.0	37.0	38.3	37.0	35.1
44.00	37.2	38.8	38.9	39.4	41.8	39.2	41.7	41.2	39.6
46.00	40.0	41.4	42.4	44.7	47.6	44.5	44.8	43.7	42.5
48.00	44.5	45.3	47.0	48.5	49.1	48.2	48.9	47.6	46.5
50.00	47.8	48.4	49.4	51.8	54.0	51.6	51.1	50.5	49.7
52.00	52.1	52.0	53.6	55.3	56.3	55.0	54.8	53.8	53.7
54.00	54.5	54.2	56.3	58.5	60.1	58.4	57.4	56.0	55.6
56.00	58.6	57.9	60.5	61.7	62.4	61.5	61.1	59.1	59.4
58.00	61.4	60.6	62.6	63.9	65.8	63.6	63.2	61.6	61.9
60.00	64.3	63.2	65.6	66.4	68.1	66.3	66.0	63.9	64.7
62.00	66.3	65.2	67.7	68.9	70.6	68.7	68.1	65.7	66.5
64.00	69.3	68.0	69.7	70.4	72.4	70.3	70.0	68.2	69.4
66.00	70.9	69.8	71.8	72.7	74.3	72.6	72.0	69.9	71.1
68.00	73.2	71.9	73.5	74.1	75.2	74.0	73.6	72.0	73.3
70.00	74.5	73.2	75.0	75.6	76.6	75.5	75.1	73.3	74.6
72.00	76.4	75.1	76.4	76.7	77.6	76.8	76.3	75.1	76.4
74.00	77.3	76.0	77.7	77.9	78.6	78.0	77.7	76.1	77.3
76.00	78.8	77.6	78.9	78.9	79.4	79.0	78.8	77.7	78.7
78.00	79.7	78.7	79.6	79.7	80.2	79.7	79.6	78.7	79.6
80.00	80.7	79.7	80.6	80.6	80.9	80.6	80.6	79.8	80.7

TABLE 25

ENCIRCLED ENERGY

Task 2.4A - Off Nominal Cube + Mfg. Error-On Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.2	0.3	0.3	0.2	0.1	0.1	0.4	0.3	0.2
10.00	1.1	1.2	1.3	0.7	0.4	0.4	1.4	1.3	1.0
15.00	3.1	3.7	3.7	1.9	1.8	1.7	3.9	3.9	2.9
20.00	6.1	6.9	7.0	4.4	4.2	4.3	7.3	7.4	6.0
25.00	9.7	10.9	11.2	9.8	10.2	9.9	11.6	11.8	10.4
30.00	15.2	16.7	16.5	15.9	16.6	16.0	17.6	18.3	16.7
35.00	23.0	25.0	23.9	23.0	24.2	23.1	26.1	26.7	24.9
40.00	30.8	32.9	32.0	32.1	32.8	32.1	35.0	35.1	33.2
45.00	38.8	40.4	40.7	43.0	45.4	42.8	43.4	42.7	41.1
50.00	47.8	48.4	49.4	51.8	54.0	51.6	51.1	50.5	49.7
55.00	57.2	56.5	58.8	60.1	61.9	59.9	59.6	57.8	58.1
60.00	64.3	63.2	65.6	66.4	68.1	66.3	66.0	63.9	64.7
65.00	70.1	68.8	71.0	71.8	73.6	71.7	71.3	69.0	70.2
70.00	74.5	73.2	75.0	75.6	76.6	75.5	75.1	73.3	74.6
75.00	78.2	77.0	78.3	78.5	79.0	78.5	78.3	77.0	78.1
80.00	80.7	79.7	80.6	80.6	80.9	80.6	80.6	79.8	80.7
85.00	82.4	81.8	82.5	82.6	82.7	82.6	82.7	82.0	82.6
90.00	84.0	83.8	84.2	84.4	84.4	84.4	84.4	84.0	84.2
95.00	85.5	85.6	85.7	85.9	86.2	85.9	85.9	85.7	85.7
100.00	86.7	87.1	87.1	87.2	87.7	87.3	87.2	87.0	86.8
105.00	87.8	88.2	88.4	88.4	88.7	88.5	88.4	88.1	87.9
110.00	88.9	89.2	89.3	89.3	89.5	89.3	89.3	89.1	89.0
115.00	89.9	90.0	90.0	90.0	90.1	90.0	90.0	90.0	89.9
120.00	90.5	90.6	90.6	90.7	90.7	90.6	90.7	90.7	90.6
125.00	91.1	91.1	91.2	91.2	91.2	91.2	91.3	91.3	91.2
130.00	91.7	91.7	91.7	91.8	91.9	91.8	91.9	91.8	91.8
135.00	92.2	92.2	92.3	92.3	92.4	92.3	92.2	92.2	92.2
140.00	92.6	92.7	92.7	92.8	92.8	92.8	92.8	92.7	92.7
145.00	93.0	93.1	93.1	93.2	93.2	93.2	93.2	93.1	93.0
150.00	93.4	93.4	93.5	93.5	93.5	93.5	93.5	93.5	93.4
155.00	93.8	93.8	93.8	93.8	93.8	93.8	93.8	93.8	93.7
160.00	94.2	94.1	94.1	94.1	94.1	94.1	94.0	94.1	94.1
165.00	94.4	94.4	94.5	94.4	94.4	94.4	94.4	94.4	94.4
170.00	94.7	94.7	94.8	94.7	94.7	94.7	94.8	94.6	94.7
175.00	95.0	95.0	95.0	95.0	95.0	95.0	95.1	95.0	95.0
180.00	95.2	95.2	95.2	95.3	95.4	95.3	95.3	95.3	95.3
184.99	95.5	95.5	95.4	95.6	95.5	95.6	95.5	95.6	95.5
189.99	95.7	95.8	95.7	95.8	95.8	95.8	95.8	95.8	95.8
194.99	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0
199.99	96.2	96.2	96.2	96.2	96.2	96.2	96.2	96.2	96.3

FIGURE 103

Wavefront Map-Q Polarization

Task 2.4A - Off Nominal Cube + Mfg. Error-On Axis

MAP IN UNITS OF 0.01 WAVES

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FIGURE 104

Wavefront Plot-Q Polarization

Task 2.4A - Off Nominal Cube + Mfg. Error-On Axis

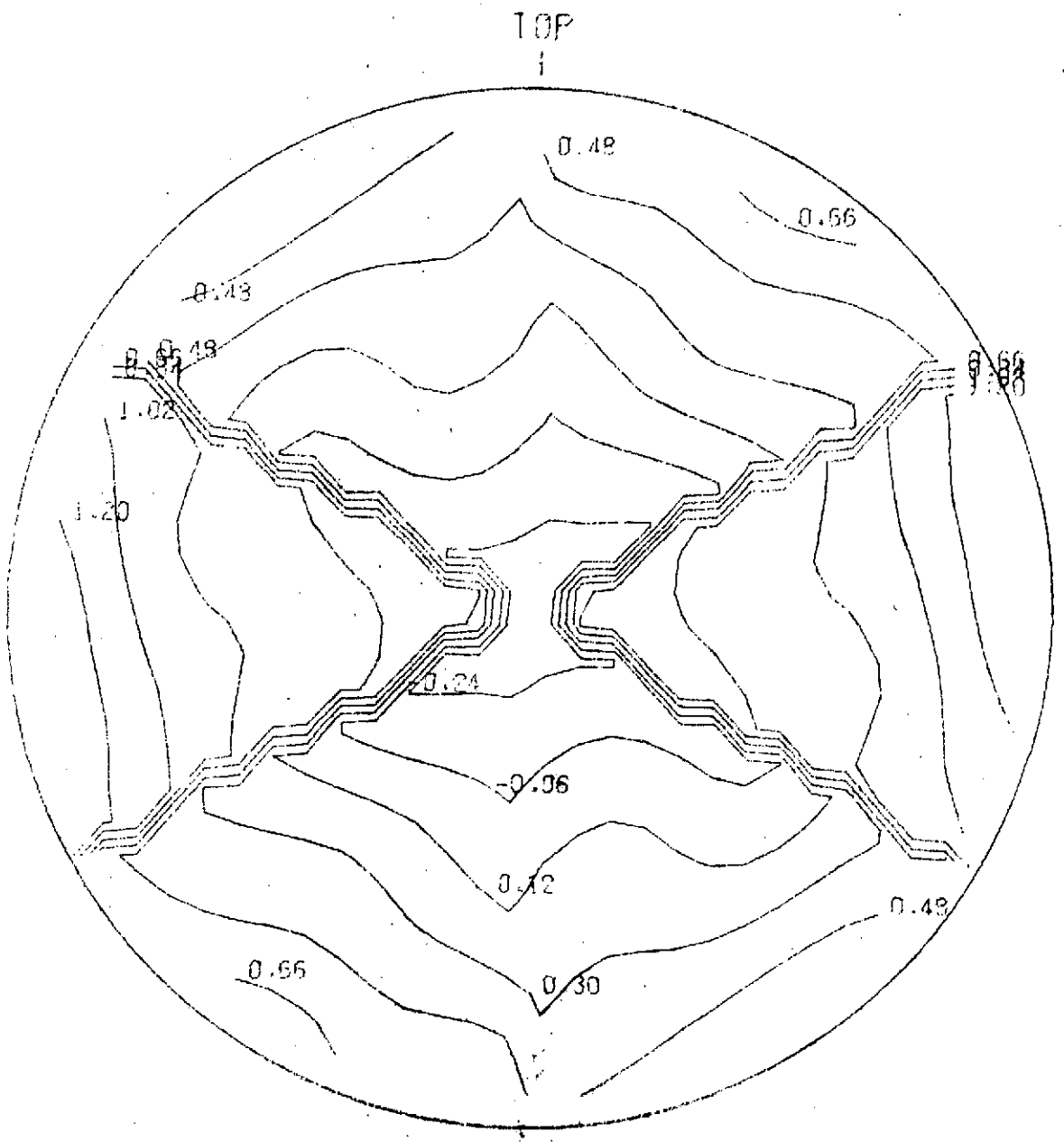


FIGURE 105

NONE

Wavefront Map-P Polarization

144

Task 2.4A - Off Nominal Cube + Mfg. Error-On Axis

MAP IN UNITS OF 0.01 WAVES

```
                                                  119 113 109 105 102  65  67  68  68  71
                                          132 125 118 111 106 102  98  94  61  64  64  65  68  75  83  92
                                      130 123 116 110 105 100  97  93  89  54  57  58  60  63  70  78  85  90
                                  127 121 114 108 102  98  95  92  90  85  44  48  51  53  57  63  70  75  78  81
                              120 117 112 105  98  93  90  89  88  86  82  32  38  42  46  50  56  61  64  66  68  71
                          111 111 107 102  95  88  85  84  84  84  83  79  23  29  34  40  45  50  54  56  57  59  62  66
                      102 102 101  98  91  84  79  76  77  79  80  78  74  16  22  28  35  41  45  48  49  50  52  55  59  65
                  120  95  94  92  88  81  74  69  69  72  75  75  74  69  10  16  22  29  35  40  42  43  44  46  49  53  59  96
                  120 115 111  85  83  72  65  61  62  66  70  71  69  64   5  10  16  22  27  32  34  36  38  40  43  79  88  95
                  122 116 111 106  73  65  58  54  56  60  65  65  63  58   1   5   8  12  17  21  25  28  31  34  67  78  87  94
              132 125 118 111 104  98  92  52  48  49  53  57  58  56  51  -3  -1   0   2   5   9  15  20  47  56  66  77  87  95 100
              136 128 119 110 102  96  91  86  79  42  45  48  50  48  43  -9  -8  -8  -7  -5   0  35  41  48  56  65  75  85  95 101
              141 131 120 109 100  94  91  87  82  77  74  39  40  39  37 -16 -15 -16 -16  30  34  39  44  49  56  63  73  83  94 103
              145 134 122 110 100  95  92  89  85  81  77  76  32  32  31 -23 -23 -23  26  32  37  42  46  50  54  61  69  81  92 103
              149 138 125 113 103  98  95  92  89  84  81  77  72  65  25 -32  10  20  27  33  37  41  45  48  51  57  66  78  91 102
              152 141 128 116 107 101  98  95  91  87  83  77  70  60 -20  37  15  22  27  31  34  39  42  45  48  53  63  75  88  99
              153 142 131 119 111 104 100  96  92  87  82  76 -12 -11 -12  43  44  44  26  27  31  35  39  42  45  50  60  72  84  95
              153 144 133 123 113 106  99  94  89  84  80  -4  -4  -4  -4  48  51  52  51  24  27  32  37  41  44  50  59  70  81  91
              151 145 136 125 115 106  98  91  85  11   6   3   3   2   1  55  59  61  60  57  54  29  36  41  46  52  60  69  78  86
              150 145 137 127 116 106  97  32  26  21  17  13  11  10   7  62  67  70  69  65  61  60  63  42  48  54  61  68  75  82
                  144 137 128 117  46  43  40  36  32  28  24  20  16  12  69  74  77  76  72  67  66  69  77  85  56  61  66  72
                  145 138 129  54  51  49  48  46  43  39  34  28  22  17  76  80  83  82  78  74  73  77  84  91  97  61  65  70
                  146  70  65  60  57  55  55  54  51  47  41  34  27  21  81  85  87  86  83  81  81  86  93 100 104 106 107  70
                       76  71  66  63  61  60  60  57  52  46  40  33  27  86  90  92  91  89  88  90  96 103 109 113 114 114
                       77  73  70  68  67  65  62  56  51  46  41  35  90  94  96  96  95  96 100 106 113 119 122 123
                           83  80  78  76  73  68  62  57  54  50  44  94  98 100 101 102 105 110 117 123 129 132
                               92  90  86  81  75  69  64  62  60  55  97 101 104 107 109 114 119 126 133 138
                                   102  96  89  82  75  71  70  69  65 101 105 109 112 116 122 128 135 141
                                        133  95  86  80  76  76  75  73 106 110 114 118 123 129 136 144
                                                  83  80  79  79  77 113 117 120 125 130
```

FIGURE 106

Wavefront Plot-P Polarization

Task 2.4A - Off Nominal Cube + Mfg. Error-On Axis

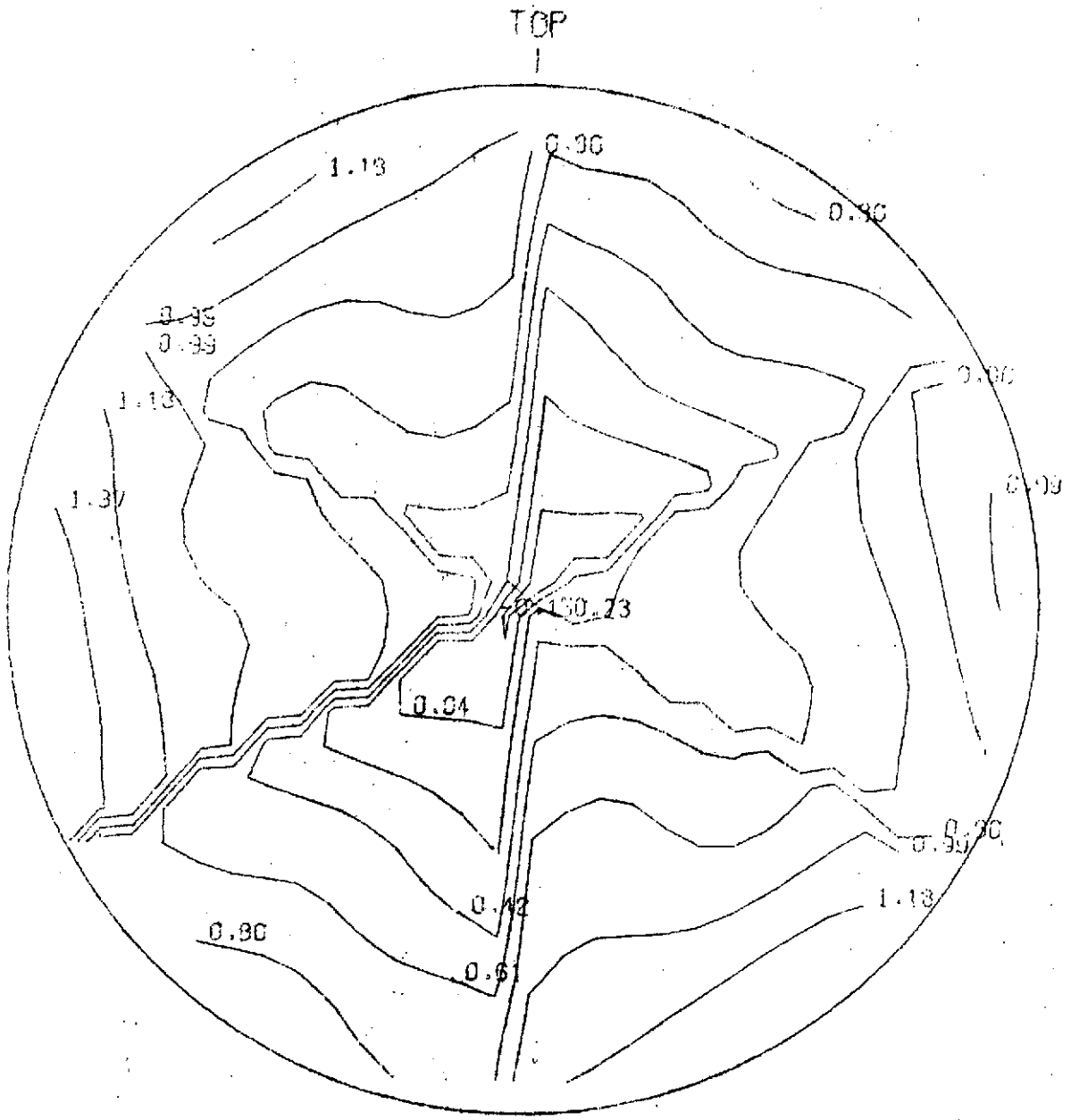


FIGURE 107 '07

Task 2.4A - Off Nominal Cube + Mfg. Error-On Axis

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0277 = 100
TOTAL ENERGY = 0.2461000D+01
MAP REPRESENTS 0.2314260D+01 OR 94.0374 PERCENT OF TOTAL ENERGY

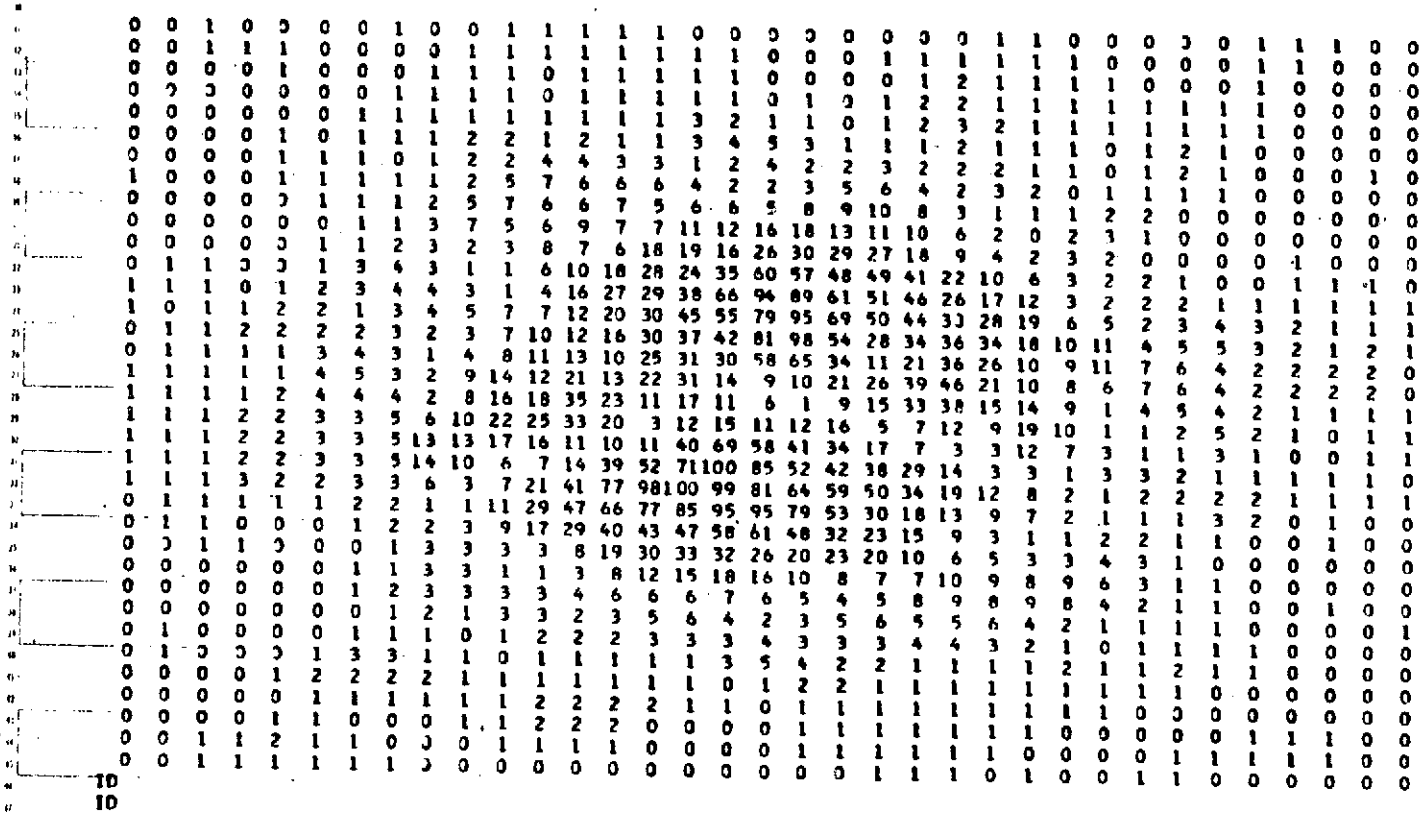


FIGURE 108

Point Spread Function

Task 2.4A - Off Nominal Cube + Mfg. Error-On Axis

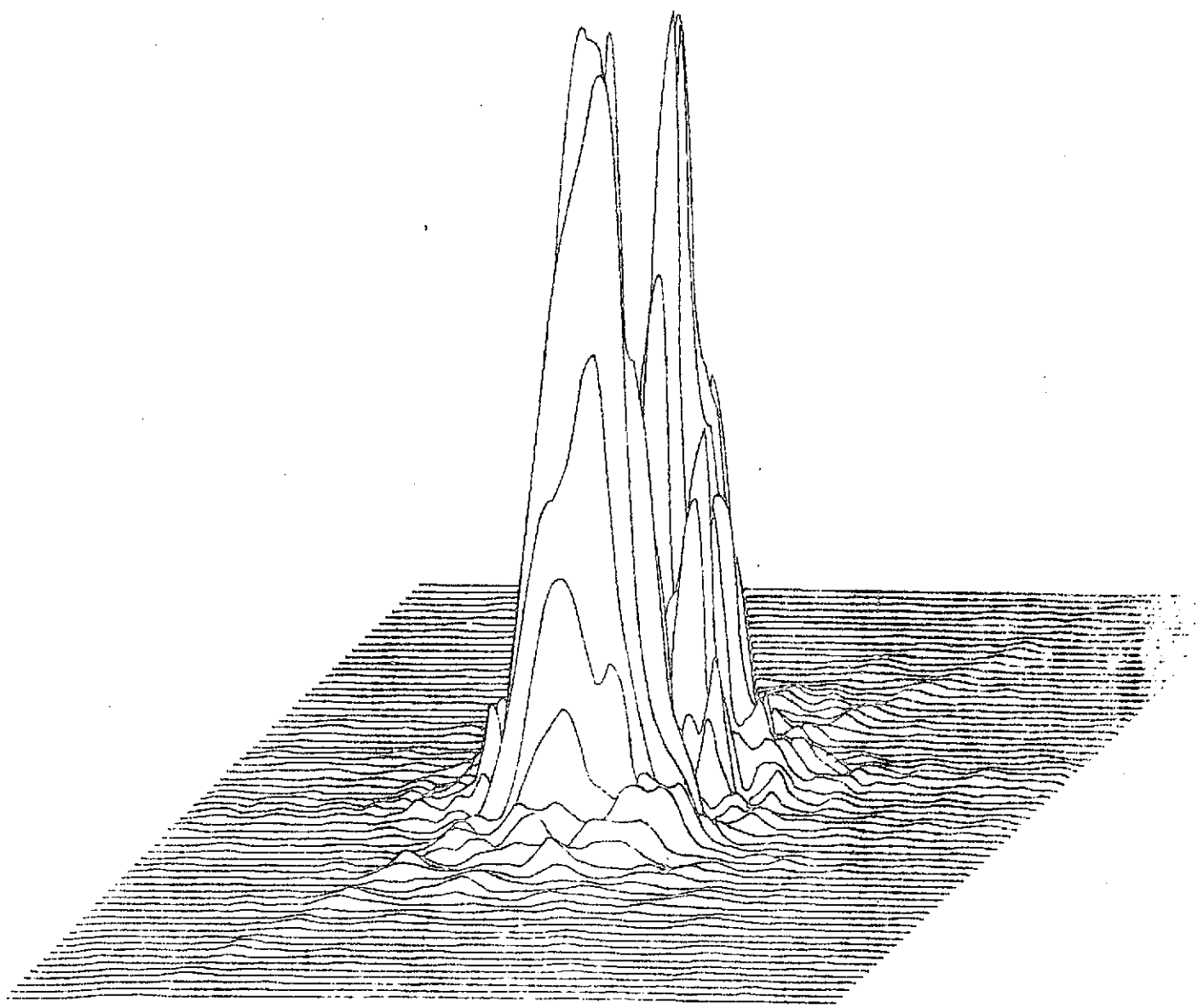
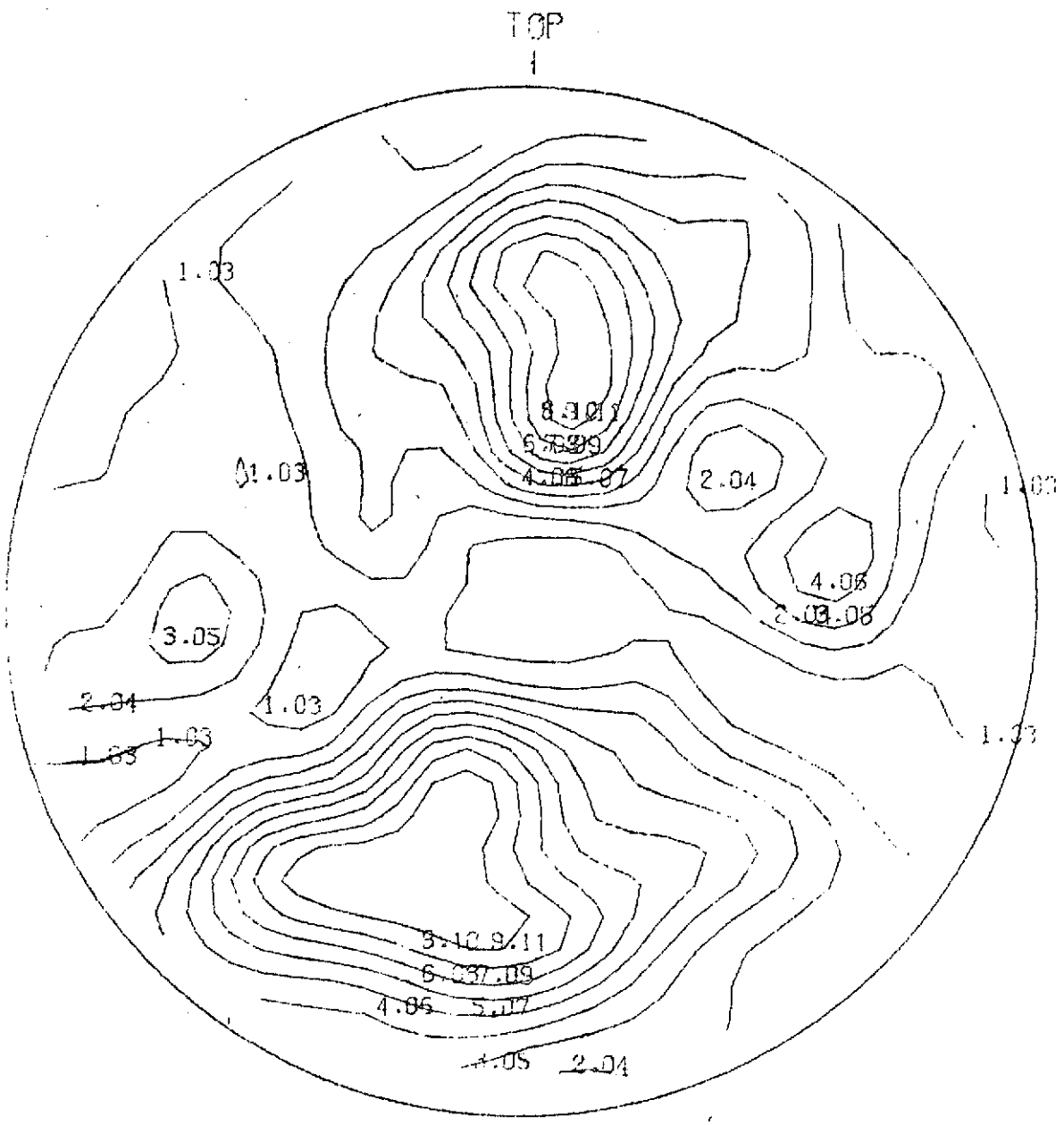


FIGURE 109

Intensity Distribution - Central 129 Microradians

Task 2.4A - Off Nominal Cube + Mfg. Error-On Axis



REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

TABLE 26

E N C I R C L E D E N E R G Y

Task 2.4A - Off Nominal Cube + Mfg. Error -15° Off Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.1	0.1	0.2	0.1	0.1	0.0	0.0
4.00	0.3	0.4	0.2	0.2	0.2	0.2	0.2	0.5	0.4
6.00	0.3	0.4	0.6	0.6	1.4	0.6	0.7	0.5	0.4
8.00	1.0	1.2	1.2	1.3	1.4	1.3	1.3	1.4	1.4
10.00	1.4	1.6	1.5	1.8	2.8	1.8	1.7	2.0	1.9
12.00	3.2	3.6	2.4	3.1	3.1	3.1	2.7	4.2	4.0
14.00	3.2	3.6	3.4	4.5	4.1	4.5	4.2	4.2	4.0
16.00	5.6	5.9	4.4	5.9	4.8	5.9	5.3	6.9	6.6
18.00	6.6	6.9	5.7	7.3	7.0	7.4	6.9	8.1	7.7
20.00	8.5	8.8	7.4	9.4	7.0	9.5	9.0	10.4	10.0
22.00	9.6	9.8	9.6	11.3	10.1	11.3	11.5	11.6	11.1
24.00	12.0	12.1	10.9	12.5	12.1	12.5	12.9	14.3	13.8
26.00	13.1	13.2	13.8	14.9	15.8	14.8	16.0	15.7	15.3
28.00	15.8	15.8	16.7	17.5	17.1	17.4	19.3	18.5	18.1
30.00	17.9	17.9	19.3	19.8	21.2	19.6	22.0	21.1	20.6
32.00	21.8	21.8	21.5	22.2	23.8	21.9	24.2	24.8	24.4
34.00	22.7	22.6	24.7	25.5	26.3	25.2	27.6	25.7	25.4
36.00	27.2	27.1	27.3	28.6	30.1	28.4	30.3	29.8	29.5
38.00	29.4	29.5	30.2	31.8	33.3	31.5	32.9	32.2	31.9
40.00	33.2	33.4	33.2	35.2	35.4	35.2	35.9	35.6	35.5
42.00	35.3	35.4	37.0	39.1	38.8	39.0	39.4	37.6	37.5
44.00	39.4	39.6	38.9	41.1	41.8	41.2	41.4	41.4	41.4
46.00	42.3	42.4	43.1	44.9	45.7	45.1	45.4	44.4	44.5
48.00	45.4	45.5	46.4	48.1	47.4	48.4	49.0	47.5	47.5
50.00	48.4	48.6	49.3	50.5	51.7	50.8	51.4	50.8	50.9
52.00	51.4	51.7	52.1	53.3	54.9	53.5	54.7	53.9	53.9
54.00	53.3	53.4	55.7	56.3	58.2	56.5	57.7	55.9	56.0
56.00	56.6	56.8	58.8	59.6	61.4	59.7	61.2	59.0	59.0
58.00	59.2	59.4	61.1	61.8	64.6	61.8	63.1	61.7	61.8
60.00	61.7	61.9	63.9	64.8	67.2	64.8	66.1	64.0	64.0
62.00	63.8	63.9	66.5	67.3	69.3	67.2	68.4	66.0	66.0
64.00	67.1	67.2	68.2	69.2	71.4	69.1	70.3	68.6	68.8
66.00	69.2	69.2	70.9	71.6	73.5	71.5	72.6	70.5	70.8
68.00	71.5	71.3	72.9	73.3	74.4	73.3	74.1	72.3	72.7
70.00	73.4	73.1	74.7	74.9	76.2	75.0	75.6	73.8	74.3
72.00	75.4	75.1	76.1	76.1	77.6	76.3	76.8	75.4	75.9
74.00	76.5	76.1	77.8	77.6	78.8	77.8	78.1	76.4	76.9
76.00	78.3	77.9	79.2	78.8	79.8	79.0	79.1	77.8	78.3
78.00	79.4	79.1	80.0	79.7	80.9	79.9	79.8	78.9	79.3
80.00	80.5	80.2	81.2	80.8	81.7	80.9	80.8	79.9	80.2

TABLE 27

ENCIRCLED ENERGY

Task 2.4A - Off Nominal Cube + Mfg. Error -15° Off Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.3	0.4	0.6	0.5	0.9	0.5	0.6	0.5	0.4
10.00	1.4	1.6	1.5	1.8	2.8	1.8	1.7	2.0	1.9
15.00	4.6	5.0	4.0	5.4	4.8	5.4	4.8	5.8	5.5
20.00	8.5	8.8	7.4	9.4	7.0	9.5	9.0	10.4	10.0
25.00	12.7	12.8	13.4	14.4	13.3	14.4	15.6	15.2	14.8
30.00	17.9	17.9	19.3	19.8	21.2	19.6	22.0	21.1	20.6
35.00	25.5	25.4	25.5	26.6	29.1	26.3	28.3	28.0	27.7
40.00	33.2	33.4	33.2	35.2	35.4	35.2	35.9	35.6	35.5
45.00	40.8	40.9	41.6	43.4	43.4	43.6	43.8	42.9	42.9
50.00	48.4	48.6	49.3	50.5	51.7	50.8	51.4	50.8	50.9
55.00	55.4	55.7	56.9	57.7	60.7	57.9	59.2	57.9	57.9
60.00	61.7	61.9	63.9	64.8	67.2	64.8	66.1	64.0	64.0
65.00	68.0	67.9	70.1	70.8	72.4	70.7	71.8	69.4	69.7
70.00	73.4	73.1	74.7	74.9	76.2	75.0	75.6	73.8	74.3
75.00	77.7	77.3	78.4	78.2	79.4	78.4	78.6	77.2	77.8
80.00	80.5	80.2	81.2	80.8	81.7	80.9	80.8	79.9	80.2
85.00	82.4	82.3	83.2	83.0	83.5	83.0	82.8	82.2	82.2
90.00	84.0	84.1	84.5	84.5	84.8	84.4	84.3	84.0	83.9
95.00	85.3	85.5	85.6	85.7	85.8	85.6	85.7	85.6	85.4
100.00	86.4	86.5	86.5	86.7	86.8	86.7	86.8	86.7	86.6
105.00	87.3	87.4	87.5	87.6	87.7	87.6	87.7	87.6	87.5
110.00	88.2	88.3	88.4	88.4	88.6	88.5	88.6	88.4	88.4
115.00	89.1	89.2	89.2	89.2	89.4	89.2	89.2	89.1	89.2
120.00	89.9	89.9	89.9	89.9	90.1	89.9	89.9	89.7	89.8
125.00	90.5	90.5	90.6	90.5	90.6	90.5	90.4	90.3	90.3
130.00	91.0	91.0	91.1	91.0	91.1	91.0	90.9	90.9	90.8
135.00	91.4	91.4	91.4	91.4	91.5	91.5	91.5	91.5	91.5
140.00	91.8	91.8	91.9	91.9	91.8	91.9	91.9	91.8	91.9
145.00	92.3	92.3	92.3	92.2	92.2	92.3	92.2	92.2	92.2
150.00	92.6	92.7	92.7	92.6	92.7	92.6	92.6	92.6	92.6
155.00	93.0	93.0	93.1	93.0	93.1	93.0	93.0	93.0	92.9
160.00	93.4	93.4	93.4	93.4	93.4	93.4	93.3	93.4	93.4
165.00	93.7	93.7	93.8	93.8	93.8	93.8	93.8	93.8	93.7
170.00	94.0	94.0	94.0	94.1	94.2	94.1	94.1	94.1	94.1
175.00	94.3	94.3	94.4	94.4	94.4	94.4	94.4	94.4	94.4
180.00	94.6	94.7	94.7	94.7	94.7	94.7	94.8	94.7	94.7
184.99	95.0	95.0	94.9	94.9	94.9	95.0	95.0	95.0	95.0
189.99	95.2	95.3	95.3	95.2	95.3	95.2	95.2	95.2	95.2
194.99	95.5	95.5	95.6	95.5	95.5	95.5	95.5	95.5	95.4
199.99	95.8	95.8	95.8	95.8	95.8	95.8	95.7	95.8	95.7

FIGURE 111

Wavefront Map-() Polarization

Task 2.4A - Off Nominal Cube + Mfg. Error -15° Off Axis

MAP IN UNITS OF 0.01 WAVES

```
                                                96  90  97 101
                                        128 119 109  99  91  85  92  96 101 105 110 115
                                    137 131 123 113 104  95  88  82  88  93  98 103 108 114 119 124
                                132 128 123 115 107  98  90  83  79  84  89  94 100 105 111 116 122 127
                            124 124 122 119 114 107 100  92  85  78  74  79  84  89  95 100 106 111 117 123 129 135
                        114 114 114 113 110 106 100  94  86  80  73  69  74  79  84  89  94  99 105 111 117 122 128 135
                        105 106 106 105 103  99  94  88  82  75  69  64  69  73  78  83  88  93  98 104 110 116 122 128
                    97  92  88 100 100  98  94  90  84  78  71  66  61  64  68  72  77  82  87  92  97 103 109  99 107 115
                105 100  96  92  87  82  93  90  86  80  74  69  63  57  60  63  67  71  76  81  86  91  82  90  98 106 113 120
                108 104 100  96  90  85  78  71  64  77  71  65  60  54  56  59  62  66  70  58  66  74  83  91  98 105 112 118
            115 111 107 103  98  93  86  79  72  65  57  51  62  56  51  51  54  57  45  52  60  68  76  84  92  99 105 111 116 121
            118 113 109 105  99  93  86  79  71  64  56  49  42  36  46  46  34  41  47  55  62  70  78  86  93  99 105 110 114 119
            120 115 110 105  99  93  85  77  69  61  54  46  39  51  48  48  54  43  50  57  64  72  79  87  93  99 104 108 112 117
            117 111 105  99  91  84  75  67  59  51  63  59  56  53  52  58  64  69  58  65  72  79  86  92  97 102 106 110
            118 112 105  98  90  82  74  65  77  73  68  64  61  58  56  61  67  73  78  83  71  77  83  89  94  98 102 106
                114 106  98  90 100  94  88  83  78  74  69  66  62  59  64  70  76  82  87  92  95  97  85  90  94  99
                116 108 118 112 106 100  95  89  84  79  75  70  66  62  67  73  79  86  92  96 100 102 103 102  90  95
                    131 125 119 113 107 101  96  90  85  80  76  71  66  71  77  84  90  97 102 106 108 109 109 109
                        131 125 119 114 108 102  97  91  86  81  76  71  76  82  89  96 103 109 114 117 118 118
                            131 125 119 114 108 102  97  92  86  82  76  81  87  95 103 111 118 123 127 129
                            129 123 118 112 107 101  96  91  86  80  86  93 101 110 119 126 432 137
                                119 114 109 104  99  95  90  84  89  97 106 116 125 134
                                    111 106 102  98  94  87  93 101 111 121
```

FIGURE 112

Wavefront Plot-Q Polarization

Task 2.4A - Off Nominal Cube + Mfg. Error -15° Off Axis

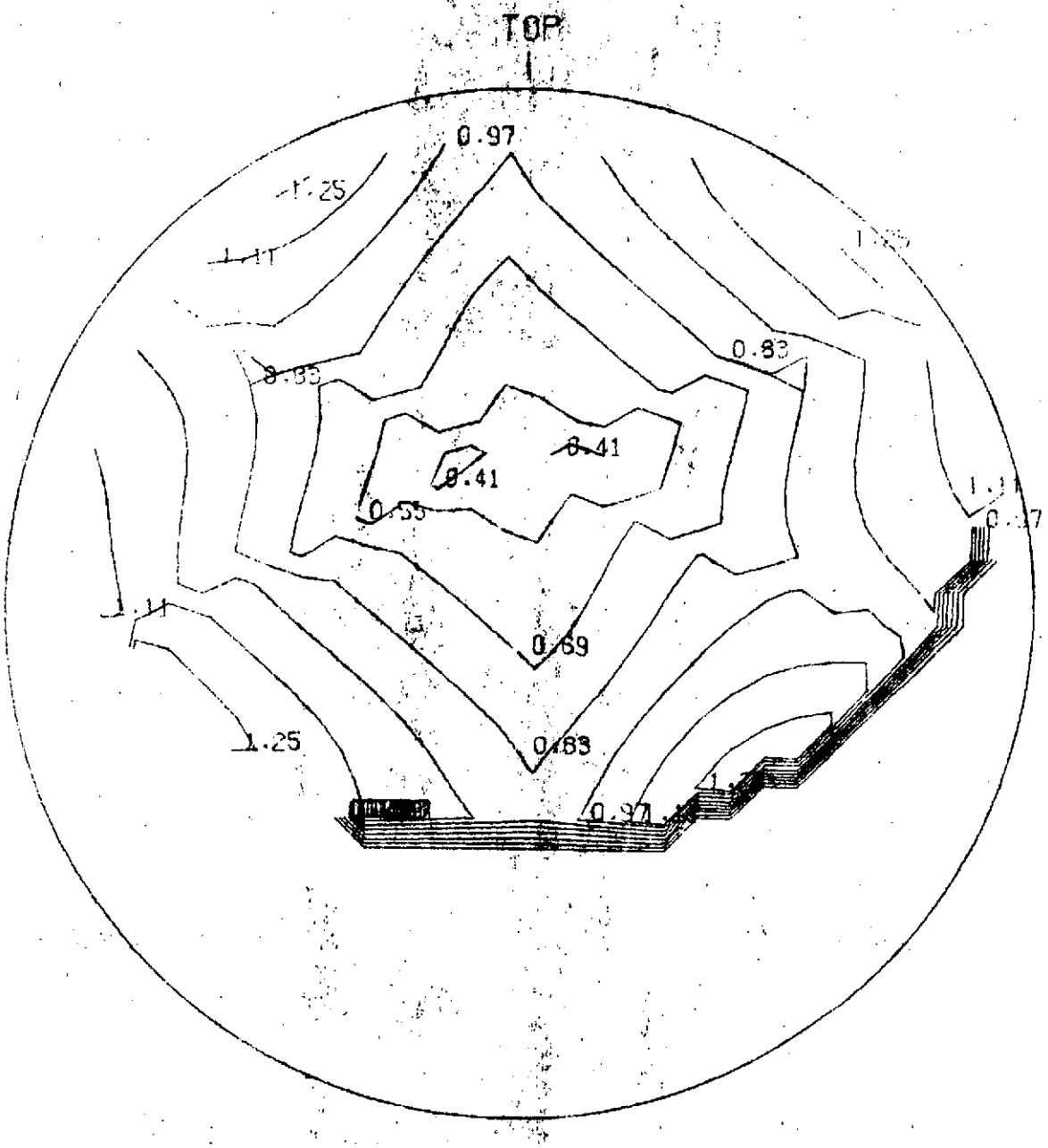


FIGURE 113

Wavefront Map-P Polarization
Task 2.4A - Off Nominal Cube + Mfg. Error -15° Off Axis

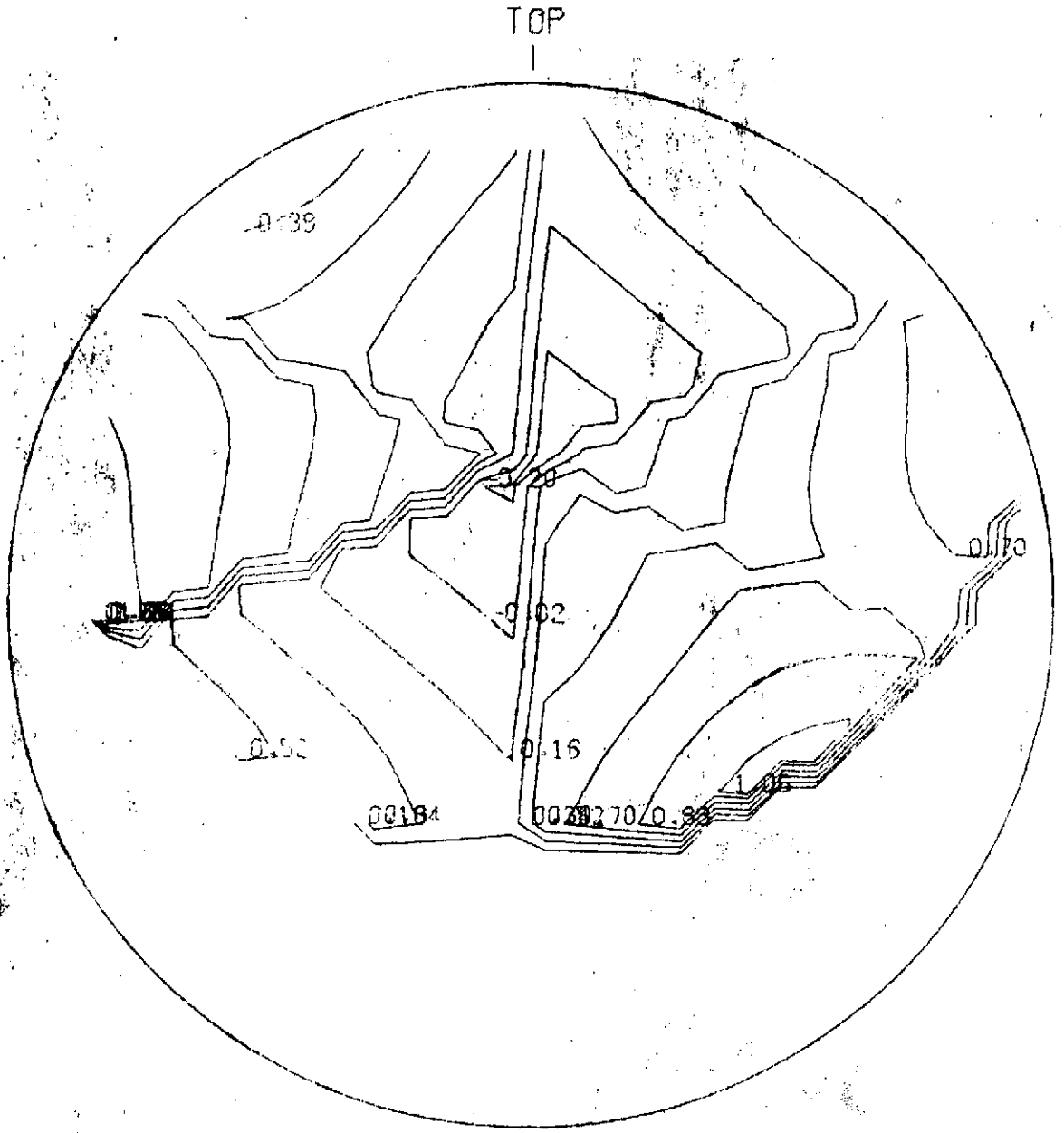
MAP IN UNITS OF 0.01 WAVES

```
                                                                66  60  16  20
                                                        98  88  78  69  61  55  11  16  20  25  30  34
                                                    106 100  92  83  74  65  57  52   8  13  17  23  28  33  38  44
                                                102  98  92  85  77  68  60  53  48   4   9  14  19  25  30  36  41  47
                                            94  93  92  88  84  77  69  62  54  48  43   0   4   9  14  20  25  31  36  42  48  54
                                        83  84  83  82  80  76  70  63  56  49  43  38  -6  -1   3   8  13  19  25  30  36  42  48  54
                                    75  75  76  75  73  69  64  58  51  44  39  34 -11  -6  -2   2   7  12  18  24  29  35  41  47
                                113 109 104  70  69  67  64  59  53  47  41  35  30 -15 -11  -7  -3   1   6  11  17  23  29  66  74  82
                            121 117 113 108 104  98  63  60  55  50  44  38  32  27 -20 -16 -12  -8  -4   0   5  11  49  57  65  73  80  87
                        125 121 117 112 107 101  95  88  81  46  41  35  29  24 -24 -21 -17 -14  -9  25  33  41  50  58  65  72  79  85
                    132 128 124 120 115 109 103  96  89  81  74  67  31  26  20 -28 -26 -22  12  19  27  35  43  51  59  66  72  78  83  88
                134 130 126 121 116 110 103  96  88  80  73  65  59  52  15 -34   1   7  14  22  29  37  45  53  60  66  72  77  81  86
            136 132 127 122 116 109 102  94  86  78  70  63  56 -19 -22  27  33  10  17  24  31  39  46  53  60  66  71  75  79  84
        133 128 122 115 108 100  92  84  76  68  -7 -11 -14 -17  31  37  42  48  25  32  39  46  53  59  64  69  73  77
    135 129 122 115 107  99  90  82   6   2  -2  -6  -9 -12  35  40  46  52  57  62  37  44  50  56  61  65  69  73
        130 123 115 107  29  23  17  12   7   3  -1  -5  -8  38  43  49  55  61  66  71  74  76  52  57  61  65
    133 124  47  41  35  29  24  18  13   8   4   0  -4  41  46  52  58  65  70  75  79  81  82  81  57  62
        60  54  48  42  36  30  25  19  14   9   4   0  45  50  56  62  69  76  81  85  87  88  88  88
            60  54  48  43  37  31  26  20  15  10   5  50  54  61  68  75  82  88  93  96  97  97
                63  54  48  43  37  31  26  21  15  11  55  60  66  74  82  90  97 102 106 108
                58  52  47  41  36  30  25  20  15  59  64  72  80  89  98 105 111 116
                    48  43  38  33  28  23  19  63  68  76  85  95 104 112
                        40  35  31  27  23  66  72  80  90 100
```

FIGURE 114

Wavefront Plot-P Polarization

Task 2.4A - Off Nominal Cube + Mfg. Error -15° Off Axis



REPRODUCIBILITY OF THE
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FIGURE 115

Task 2.4A - Off Nominal Cube + Mfg. Error -15° Off Axis

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0174 = 100
TOTAL ENERGY = 0.1873400D+01
MAP REPRESENTS 0.1742575D+01 OR 93.1659 PERCENT OF TOTAL ENERGY

```
  0  0  0  0  0  1  1  1  1  1  0  0  0  1  0  0  0  0  0  0  0  0  1  1  0  0  0  1  1  1  0  0  0  0  0
  0  0  0  1  1  1  1  1  1  1  0  0  0  1  1  0  1  0  0  1  1  1  1  1  0  1  1  0  1  1  1  0  0  0  0  0
  0  0  0  0  1  1  1  1  1  1  0  1  1  1  1  1  2  1  1  3  2  1  1  1  0  1  1  1  0  1  1  0  0  0  0  0
  0  0  0  0  0  1  1  2  1  1  1  1  1  0  1  2  3  2  2  3  2  1  1  1  1  1  1  1  1  1  0  0  0  0  0  0
  0  0  0  0  0  0  1  1  1  2  1  1  0  0  2  2  2  3  2  1  0  1  0  1  1  1  1  1  1  1  0  0  0  0  0  0
  0  0  0  0  0  0  1  1  1  2  2  1  2  1  0  1  1  1  2  2  1  1  1  0  1  2  1  1  1  1  0  0  0  1  1  0
  1  0  0  0  0  1  2  2  2  3  2  2  3  1  1  3  3  2  2  4  4  1  1  2  2  2  2  2  1  0  1  0  1  1  0  0
  1  0  0  0  1  1  2  2  3  3  2  4  3  1  4  6  6  5  5  8  8  2  1  3  3  2  2  2  1  0  1  0  1  1  0  0
  0  0  0  0  1  1  2  2  3  4  4  5  5  6  8  7  7  8  6  9 10  7  5  6  4  2  2  2  1  0  0  0  1  1  0  0
  0  0  0  1  0  0  1  2  3  4  4  6  8 11  9  5  7  8  8  8  8 10 12  9  4  2  2  1  1  0  0  0  0  0  0  0
  1  1  0  1  0  1  2  1  1  3  5  6 11 14 11 10 10  6 11 16 12 12 13 10  6  2  1  1  1  1  0  0  0  1  1  0
  1  1  1  1  1  2  2  2  4  8  9 10 19 24 23 26 17  4 15 27 25 25 20 13 12  5  1  0  1  3  2  1  0  1  1  0
  1  2  2  2  1  2  3  5 11 14 13 19 36 39 41 46 29  9 19 31 37 48 39 22 19 11  3  2  2  4  4  3  1  1  1  0
  1  2  2  2  1  1  3  7 13 14 16 33 49 42 49 57 33 18 28 39 45 59 55 32 22 13  4  2  2  3  3  2  1  1  1  0
  1  2  2  1  1  2  4  7  9 13 25 50 53 36 55 58 22 16 34 57 62 56 55 42 25 12  4  3  3  4  2  2  1  2  2  0
  2  2  1  1  2  4  6  6  7 16 35 56 47 37 72 58 16 22 33 66 79 49 48 54 36 15  5  3  5  5  3  1  1  2  2  0
  1  1  1  1  2  4  5  4  6 15 27 36 26 35 76 52 31 57 37 51 73 35 32 48 35 17  6  3  3  3  2  1  1  1  1  0
  0  0  0  1  1  2  1  1  4  8  9  8  4 24 60 40 44 82 44 38 58 19  7 18 16 12  6  2  0  1  1  1  0  0  0  0
  1  0  0  1  2  1  0  2  4  5  3  5 12 31 63 54 44 57 42 58 67 25  7  3  1  7  7  4  2  1  1  1  1  0  0  0
  1  1  1  2  2  2  2  4  4  6  9 22 45 65 92 93 51 21 39 88 89 55 44 23  5  5  6  6  4  3  2  1  1  1  1  0
  1  0  1  1  1  2  2  3  2  4 12 36 74 92 99100 57 16 41 89 88 79 78 44 12  4  3  4  4  3  1  1  0  1  1  0  0
  0  0  1  1  1  2  2  2  1  5 21 46 82 93 75 61 39 19 36 60 66 79 80 46 20 10  5  2  2  2  1  1  1  0  1  0
  1  1  1  1  1  2  2  2  2 10 31 51 70 75 53 28 14 11 22 35 47 62 60 40 29 19  9  3  1  1  1  1  1  0  0  0
  0  0  1  1  1  2  1  1  1  7 26 38 40 44 39 24  8  6 14 25 34 37 33 28 25 16  6  3  2  1  0  1  1  0  0  0
  0  0  0  0  0  1  1  0  0  2  9 15 13 14 20 21 13  9 12 18 18 13 11 11  9  4  1  2  2  0  0  0  0  0  0  0
  0  0  0  0  0  0  1  0  1  1  1  3  4  3  5 10 12 10  8  8  6  4  3  1  0  1  0  1  1  0  0  0  0  0  0  0
  0  0  0  0  0  0  0  1  1  2  3  2  2  4  3  3  6  9  9  6  4  3  3  3  2  3  4  1  0  1  0  0  0  0  0  0
  0  0  1  0  0  0  1  3  3  4  5  4  2  3  6  7  5  6  6  4  2  2  4  5  6  6  3  2  2  0  0  0  0  0  0  0
  0  0  1  0  0  0  1  3  5  4  4  4  1  2  7  7  3  3  5  4  1  1  3  5  5  5  5  4  2  0  0  0  0  0  0  0
  0  0  1  1  0  0  0  2  3  2  2  2  2  2  5  6  3  1  2  2  0  2  3  3  3  3  3  2  1  0  0  0  0  0  0  0
  0  0  0  1  0  0  0  0  1  1  0  1  1  1  2  3  3  1  1  0  0  1  1  1  1  1  0  0  0  0  0  0  0  0  0  0
  0  0  0  1  0  0  0  0  1  0  0  0  0  1  1  1  1  1  1  1  1  0  1  1  1  1  0  0  0  0  0  0  0  0  0  0
  0  0  0  0  1  1  1  1  1  1  0  0  1  1  1  1  1  0  1  1  1  1  0  0  0  0  1  2  2  1  1  1  1  0  0  0
  0  0  0  0  1  1  2  1  1  1  0  0  1  1  1  1  1  0  0  1  1  1  1  0  0  0  1  2  2  3  2  1  0  0  0  0
  0  0  0  0  1  1  2  1  1  1  0  1  2  1  0  0  0  0  1  1  1  1  1  0  0  1  1  2  2  1  0  0  0  0  0  0
ID
ID
```

FIGURE 116

Point Spread Function

Task 2.4A - Off Nominal Cube + Mfg. Error -15° Off Axis

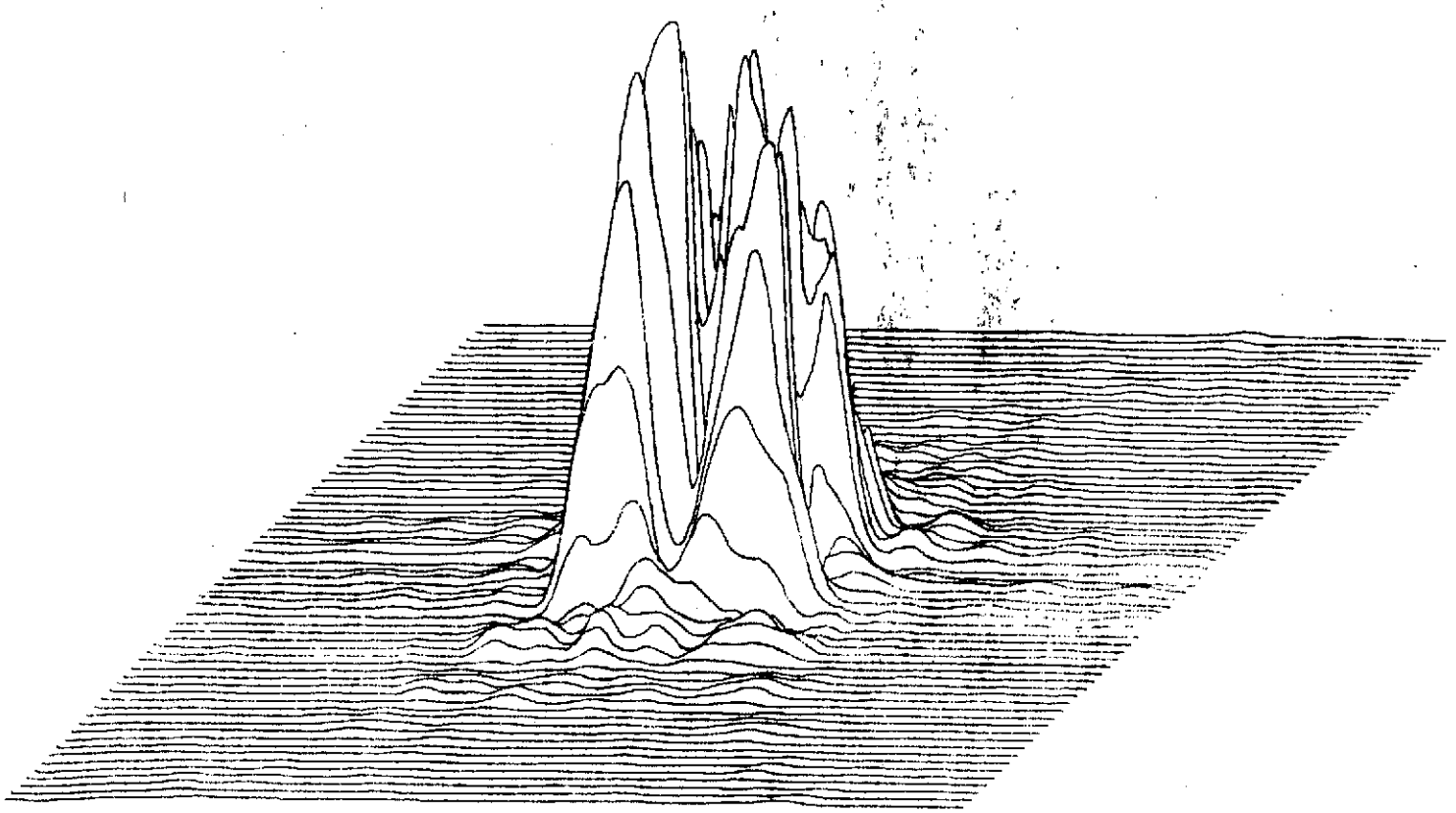


FIGURE 117

Intensity Distriubtion - Central 129 Microradians

Task 2.4A - Off Nominal Cube + Mfg. Error -15° Off Axis

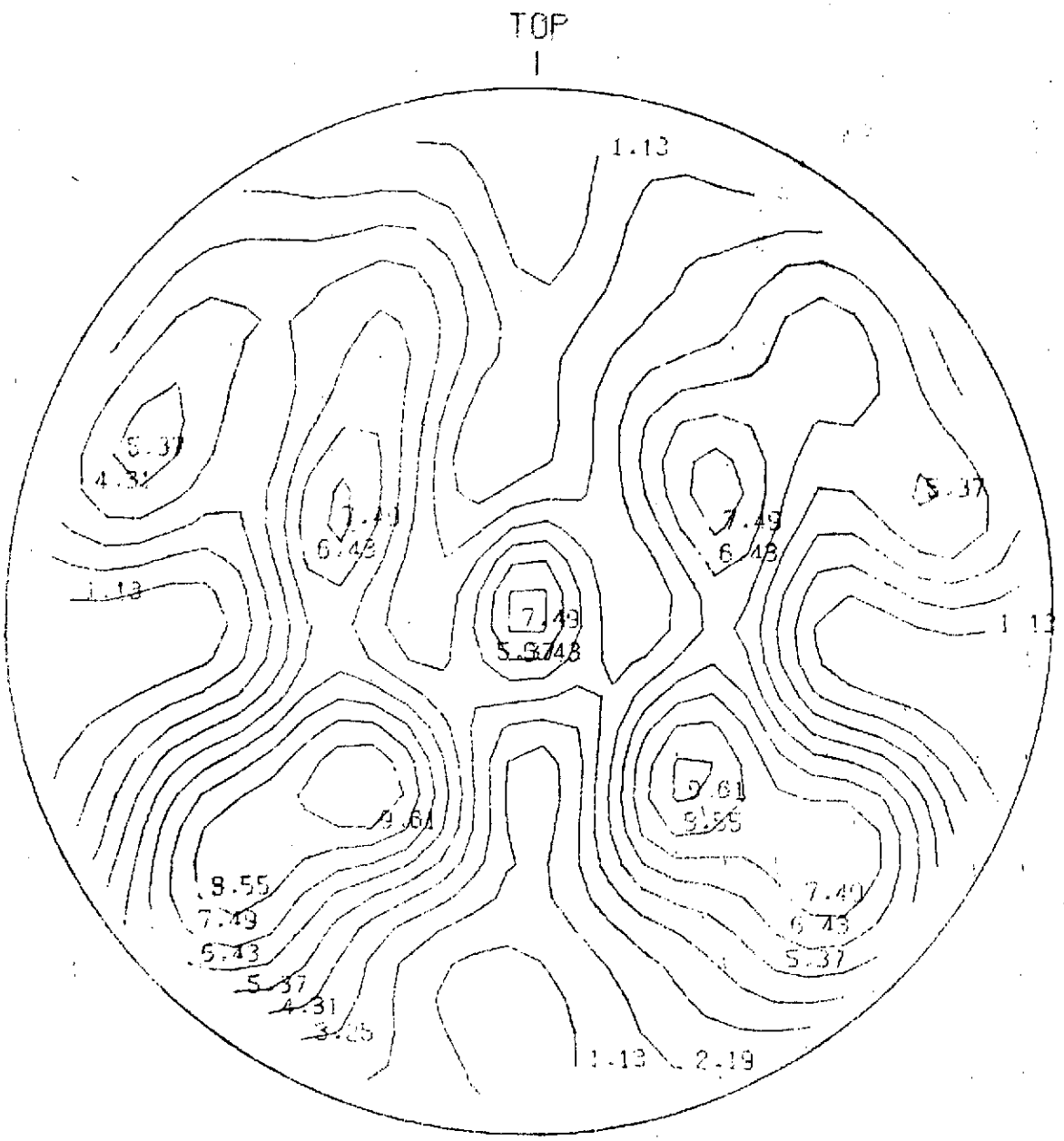


FIGURE 118

Encircled Energy

Vs

Field Angle

Task 2.4A - Off Nominal Cube

+ Mfg. Error -15° Off Axis

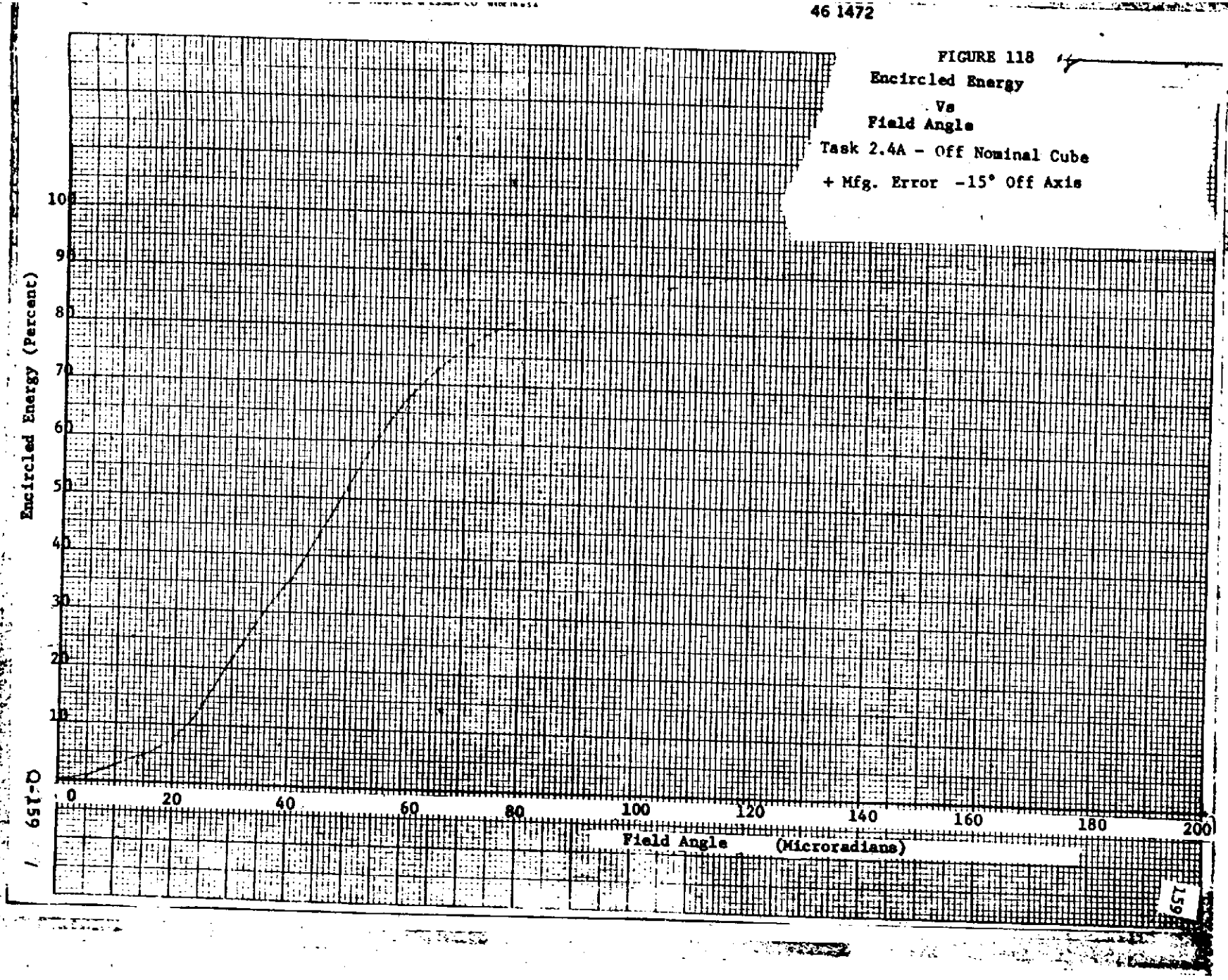


TABLE 28

ENCIRCLED ENERGY

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature-On Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.0
4.00	0.2	0.2	0.1	0.1	0.0	0.0	0.1	0.3	0.2
6.00	0.2	0.2	0.4	0.3	0.1	0.1	0.5	0.3	0.2
8.00	0.8	0.8	0.7	0.5	0.1	0.2	0.8	0.9	0.7
10.00	1.1	1.1	1.1	0.7	0.4	0.4	1.2	1.2	1.0
12.00	2.3	2.4	1.8	1.1	0.5	0.7	2.0	2.6	2.1
14.00	2.3	2.4	2.8	1.8	1.2	1.5	3.0	2.6	2.1
16.00	3.7	4.2	3.7	2.3	1.7	2.0	4.0	4.4	3.5
18.00	4.4	4.8	4.8	3.3	4.0	3.2	5.0	5.1	4.3
20.00	5.9	6.6	6.6	4.3	4.0	4.3	6.9	7.0	5.8
22.00	6.6	7.2	7.9	6.1	7.1	6.2	8.2	7.8	6.7
24.00	8.7	9.6	9.6	7.2	8.3	7.4	9.8	10.3	9.0
26.00	9.8	10.7	11.3	9.6	11.5	9.8	11.6	11.6	10.4
28.00	12.7	14.1	14.3	12.4	12.4	12.6	15.1	15.1	13.6
30.00	14.6	16.0	15.9	15.2	15.9	15.3	16.8	17.4	16.0
32.00	18.7	20.4	19.0	17.4	17.5	17.6	20.3	21.9	20.3
34.00	19.6	21.4	21.4	21.4	21.0	21.5	23.1	22.9	21.2
36.00	24.0	26.0	24.8	24.0	24.0	24.0	27.1	27.6	25.8
38.00	26.0	28.1	27.6	27.8	28.9	27.8	29.9	30.1	28.1
40.00	29.9	32.0	31.0	30.8	31.3	30.7	33.9	34.0	32.1
42.00	31.7	33.8	34.6	35.5	37.5	35.5	37.2	35.9	34.0
44.00	36.2	37.8	37.8	38.0	40.2	37.7	40.5	40.1	38.4
46.00	39.1	40.4	41.3	43.3	46.1	43.1	43.7	42.7	41.4
48.00	43.4	44.3	45.8	47.1	47.6	46.8	47.9	46.6	45.5
50.00	46.7	47.3	48.3	50.5	52.7	50.3	50.1	49.5	48.6
52.00	51.1	51.0	52.5	54.1	55.1	53.8	53.9	53.0	52.7
54.00	53.4	53.3	55.2	57.5	59.1	57.4	56.5	55.2	54.8
56.00	57.7	57.2	59.6	60.9	61.5	60.7	60.5	58.6	58.7
58.00	60.6	60.0	61.7	63.2	65.2	63.0	62.6	61.1	61.3
60.00	63.6	62.8	65.1	65.9	67.6	65.8	65.7	63.6	64.2
62.00	65.7	64.8	67.2	68.6	70.3	68.4	67.9	65.5	66.0
64.00	68.8	67.8	69.4	70.2	72.2	70.1	70.0	68.2	69.2
66.00	70.6	69.7	71.6	72.7	74.5	72.6	72.1	69.9	70.9
68.00	73.0	71.9	73.6	74.2	75.5	74.2	73.8	72.2	73.3
70.00	74.4	73.3	75.2	75.9	77.1	75.9	75.3	73.5	74.6
72.00	76.4	75.3	76.7	77.1	78.2	77.1	76.7	75.4	76.6
74.00	77.5	76.3	78.1	78.5	79.3	78.5	78.0	76.4	77.5
76.00	79.1	78.0	79.4	79.5	80.1	79.5	79.2	78.0	79.1
78.00	80.1	79.1	80.1	80.3	80.9	80.3	80.0	79.1	80.0
80.00	81.2	80.2	81.2	81.2	81.6	81.2	81.1	80.2	81.1

TABLE 29

ENCIRCLED ENERGY

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature-On Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.2	0.2	0.3	0.2	0.1	0.1	0.3	0.3	0.2
10.00	1.1	1.1	1.1	0.7	0.4	0.4	1.2	1.2	1.0
15.00	3.1	3.5	3.4	2.0	1.7	1.8	3.7	3.6	2.9
20.00	5.9	6.6	6.6	4.3	4.0	4.3	6.9	7.0	5.8
25.00	9.4	10.4	10.7	9.4	9.8	9.6	11.0	11.2	9.9
30.00	14.6	16.0	15.9	15.2	15.9	15.3	16.8	17.4	16.0
35.00	22.3	24.2	23.2	22.0	23.1	22.1	25.0	25.6	24.0
40.00	29.9	32.0	31.0	30.8	31.3	30.7	33.9	34.0	32.1
45.00	37.8	39.4	39.6	41.5	43.8	41.4	42.3	41.6	40.0
50.00	46.7	47.3	48.3	50.5	52.7	50.3	50.1	49.5	48.6
55.00	56.2	55.7	57.9	59.2	61.0	59.0	58.9	57.2	57.3
60.00	63.6	62.8	65.1	65.9	67.6	65.8	65.7	63.6	64.2
65.00	69.7	68.6	70.8	71.8	73.6	71.7	71.3	69.0	70.0
70.00	74.4	73.3	75.2	75.9	77.1	75.9	75.3	73.5	74.6
75.00	78.4	77.3	78.8	79.0	79.7	79.0	78.7	77.4	78.4
80.00	81.2	80.2	81.2	81.2	81.6	81.2	81.1	80.2	81.1
85.00	83.0	82.2	83.1	83.2	83.3	83.2	83.2	82.4	83.1
90.00	84.5	84.1	84.6	84.8	84.8	84.8	84.8	84.3	84.7
95.00	85.9	85.9	86.0	86.2	86.4	86.2	86.2	86.0	86.1
100.00	87.0	87.3	87.3	87.4	87.8	87.5	87.4	87.2	87.1
105.00	88.0	88.4	88.5	88.5	88.9	88.6	88.5	88.3	88.1
110.00	89.1	89.3	89.5	89.4	89.6	89.4	89.4	89.3	89.1
115.00	90.0	90.1	90.2	90.1	90.2	90.1	90.1	90.1	90.0
120.00	90.6	90.7	90.7	90.7	90.8	90.7	90.8	90.8	90.7
125.00	91.2	91.2	91.3	91.3	91.3	91.3	91.4	91.3	91.3
130.00	91.8	91.7	91.8	91.9	91.9	91.9	91.9	91.8	91.8
135.00	92.3	92.3	92.3	92.3	92.5	92.3	92.3	92.3	92.2
140.00	92.7	92.7	92.8	92.8	92.9	92.8	92.8	92.8	92.7
145.00	93.1	93.1	93.1	93.2	93.2	93.2	93.2	93.1	93.1
150.00	93.4	93.5	93.5	93.5	93.6	93.5	93.5	93.5	93.4
155.00	93.8	93.8	93.8	93.8	93.8	93.8	93.8	93.8	93.8
160.00	94.2	94.2	94.2	94.1	94.1	94.1	94.1	94.1	94.1
165.00	94.5	94.4	94.5	94.4	94.4	94.4	94.4	94.4	94.4
170.00	94.7	94.7	94.8	94.7	94.8	94.7	94.8	94.7	94.7
175.00	95.0	95.0	95.0	95.0	95.1	95.0	95.1	95.0	95.0
180.00	95.3	95.3	95.3	95.3	95.4	95.3	95.3	95.3	95.3
184.99	95.5	95.5	95.5	95.6	95.6	95.6	95.5	95.6	95.6
189.99	95.7	95.8	95.8	95.8	95.8	95.9	95.8	95.8	95.8
194.99	96.0	96.0	96.0	96.0	96.1	96.0	96.0	96.0	96.0
199.99	96.3	96.3	96.2	96.2	96.3	96.3	96.2	96.3	96.3

FIGURE 119

Wavefront Map-Q Polarization

Task 2.432 - Off Nominal Cube + Mfg. Error + First Temperature-On Axis

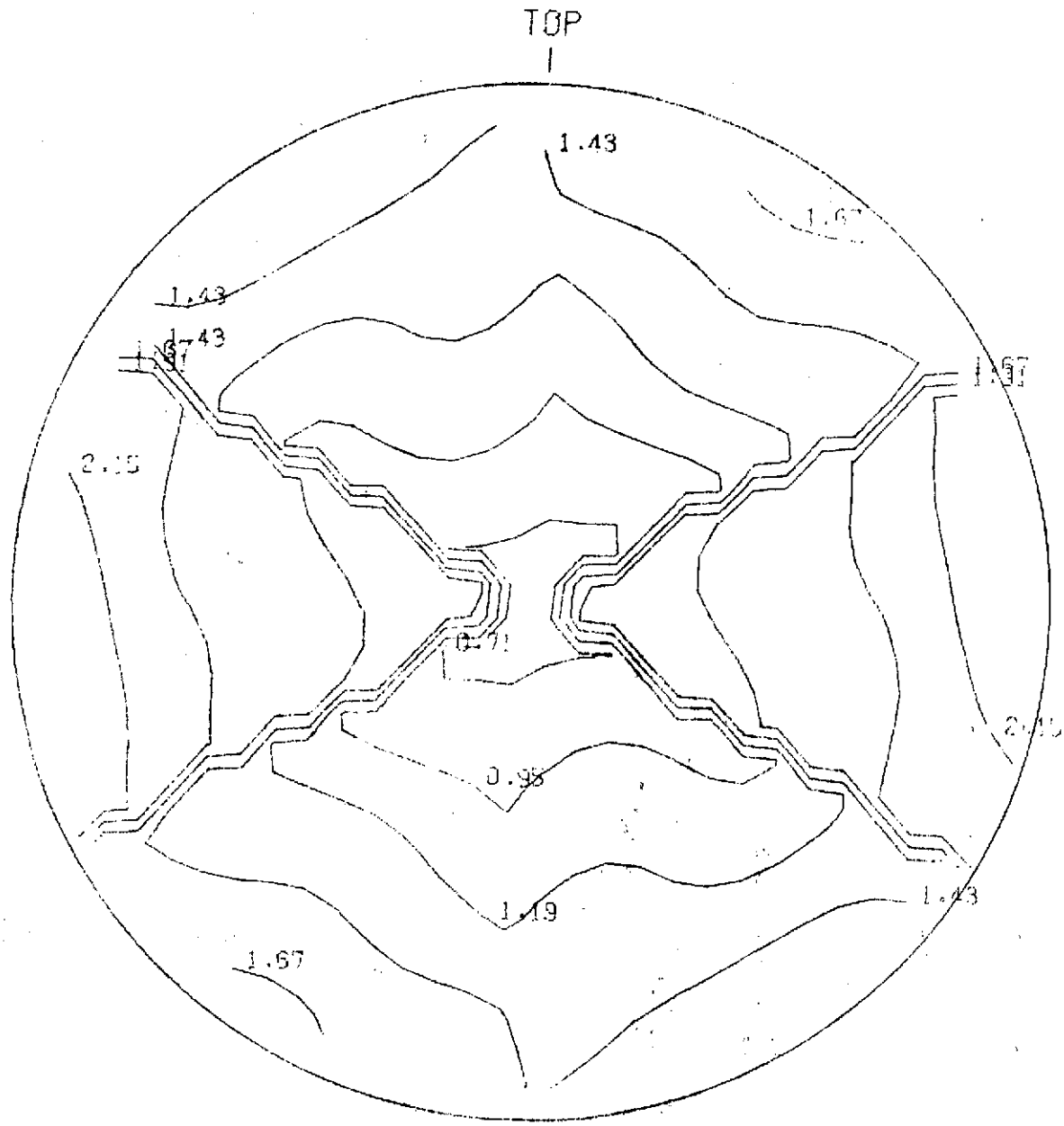
MAP IN UNITS OF 0.01 WAVES

```
                                                159 153 148 144 140 154 156 157 158 161
                                            173 168 159 153 148 143 139 135 152 154 155 156 159 166 175 183
                                        171 165 159 152 147 143 139 135 131 145 149 150 152 156 163 170 177 181
                                    168 163 157 151 145 141 138 135 132 128 136 141 143 146 150 157 163 167 170 172
                                161 159 154 148 142 137 134 132 131 129 125 125 131 135 139 144 150 154 157 159 160 161
                            150 151 149 144 138 132 128 127 127 127 125 121 116 122 127 133 138 143 147 149 149 150 152 155
                        140 141 142 140 134 127 122 120 120 122 122 120 116 107 114 121 127 134 138 141 142 142 143 146 149 152
                    199 134 134 134 130 124 117 112 112 114 117 117 115 111 101 107 114 122 128 133 135 136 137 138 140 143 147 226
                201 197 194 127 122 115 108 104 105 108 112 112 109 104  96 101 107 114 119 124 127 129 130 132 134 212 220 225
            204 199 195 190 116 107 100  96  97 101 105 105 103  97  90  94  98 103 108 112 117 121 124 126 202 211 220 226
        214 208 202 195 189 183 177  93  89  90  94  97  98  95  90  85  87  89  92  95 100 106 112 182 191 201 211 220 227 231
    219 212 203 195 187 181 176 170 163  83  85  88  89  87  82  78  80  80  81  84  89 169 175 183 191 200 210 220 229 234
224 216 205 194 185 179 176 171 165 159 156  78  79  77  74  71  72  72  72 162 167 172 178 184 191 199 208 219 229 236
229 220 208 196 186 180 177 173 168 163 159 157  70  70  68  62  64  64 157 164 170 175 180 185 190 196 205 215 227 237
233 223 211 198 189 183 180 176 172 167 162 158 152 144  62  53 139 150 158 164 169 174 179 183 187 193 202 214 226 236
236 226 214 202 193 187 183 179 174 169 164 158 150 139  53  62 144 152 158 162 167 172 176 180 183 189 198 211 223 233
237 227 216 205 196 190 185 180 175 170 164 157  64  64  62  68  70  70 157 159 163 168 173 177 180 186 196 208 220 229
236 229 219 208 199 191 184 178 172 167 162  72  72  72  71  74  77  79  78 156 159 165 171 176 179 185 194 205 216 224
234 229 220 210 200 191 183 175 169  89  84  81  80  80  78  82  87  89  88  85  83 163 170 176 181 187 195 203 212 219
231 227 220 211 201 191 182 112 106 100  95  92  89  87  85  90  95  98  97  94  90  89  93 177 183 189 195 202 208 214
    226 220 211 202 126 124 121 117 112 108 103  98  94  90  97 103 105 105 101  97  96 100 107 116 190 195 199 204
    225 223 212 134 132 130 129 127 124 119 114 107 101  96 104 109 112 112 108 105 104 108 115 122 127 194 197 201
    226 147 143 140 138 137 136 135 133 128 122 114 107 101 111 115 117 117 114 112 112 117 124 130 134 134 134 199
        152 149 146 143 142 142 141 138 134 127 121 114 107 116 120 122 122 120 120 122 127 134 140 142 141 140
            155 152 150 149 149 147 143 138 133 127 122 116 121 125 127 127 127 128 132 138 144 149 151 150
                161 160 159 157 154 150 144 139 135 131 125 125 129 131 132 134 137 142 148 154 159 161
                    172 170 167 163 157 150 146 143 141 136 128 132 135 138 141 145 151 157 163 168
                        181 177 170 163 156 152 150 149 145 131 135 139 143 147 152 159 165 171
                            183 175 166 159 156 155 154 152 135 139 143 148 153 159 166 173
                                161 158 157 156 154 140 144 148 153 159
```

FIGURE 120

Wavefront Plot-Q Polarization

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature-On Axis



REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

FIGURE 121

Wavefront Map-P Polarization

Task 2.482 - Off Nominal Cube + Mfg. Error + First Temperature-On Axis

MAP IN UNITS OF 0.01 WAVES

```
                                                  217 211 206 202 199 162 165 165 166 170
                                              232 225 218 211 206 201 197 193 160 163 164 165 168 175 183 192
                                          230 224 217 211 205 201 197 193 189 154 157 159 160 164 171 179 185 190
                                      226 221 216 209 203 199 196 194 190 186 144 149 152 154 159 165 171 176 179 180
                                  219 217 212 206 200 195 192 191 190 187 183 133 139 144 147 152 158 163 166 167 168 170
                              209 210 208 203 196 190 186 185 186 186 184 180 124 130 136 141 146 152 156 157 158 159 161 163
                          198 200 201 198 192 186 180 178 179 181 181 179 175 116 122 129 136 142 147 150 150 151 152 154 157 161
                      219 192 193 192 189 182 175 171 170 173 175 176 174 169 110 116 123 130 136 141 144 144 145 146 148 152 156 192
                  217 213 210 185 180 173 166 162 163 167 170 170 168 163 104 109 115 122 128 132 135 138 139 141 143 178 186 191
              220 215 211 206 174 166 158 155 156 160 164 164 161 156  99 103 107 111 116 121 125 129 132 135 168 177 186 192
          233 224 218 211 205 199 193 152 148 149 152 156 156 154 148  93  96  98 100 104 109 119 121 148 157 167 177 186 193 197
      235 228 219 211 203 197 192 186 179 141 144 146 147 145 140  87  88  89  90  93  98 135 141 149 157 166 176 186 195 200
  240 232 221 210 201 195 192 187 181 175 172 136 137 136 133  79  80  80  80 128 133 138 144 150 157 165 174 185 195 202
245 236 224 212 202 196 193 189 184 179 175 173 129 128 126  71  72  72 123 130 136 141 146 151 156 162 171 182 193 203
249 239 227 214 205 199 196 192 188 183 178 174 168 160 120  62 105 116 124 130 135 140 145 149 153 159 168 180 192 202
252 242 230 218 209 203 199 195 190 185 180 174 166 155  73 132 110 118 124 128 133 138 142 146 149 155 164 177 189 199
253 243 232 221 212 206 201 196 191 186 180 173  84  84  83 138 140 140 123 125 129 134 139 143 146 152 162 174 186 195
252 245 235 224 215 207 200 194 188 183 178  92  92  92  91 145 148 149 148 122 125 131 137 142 145 151 160 171 182 190
250 245 236 226 216 207 199 191 185 110 104 101 100 100  98 152 157 159 158 155 153 129 136 142 147 153 161 169 178 185
247 243 236 227 217 207 198 132 126 121 115 112 109 107 105 160 165 168 167 164 160 160 164 143 149 155 161 168 174 180
    242 236 227 218 146 144 141 137 132 128 123 118 115 111 168 173 176 175 172 167 166 170 178 186 156 161 165 170
    241 236 228 154 152 151 149 147 144 139 134 127 121 116 175 179 182 182 178 175 174 178 185 192 197 163 163 167
    242 167 163 160 158 157 156 155 153 148 142 134 127 121 181 185 188 187 185 182 183 187 194 200 204 204 204 165
        172 169 166 164 162 162 161 159 154 148 141 134 127 186 191 193 192 190 190 192 197 204 210 212 212 210
            175 172 170 169 169 167 163 158 153 147 142 136 191 195 197 197 197 198 202 208 214 219 221 221
                181 180 179 177 174 170 164 159 155 151 145 195 199 202 203 204 207 212 218 224 229 231
                    192 190 187 183 177 170 166 163 161 156 198 202 205 208 211 215 221 227 233 238
                        201 197 190 183 176 172 170 169 165 201 205 209 213 217 223 229 235 241
                            203 195 186 180 176 175 174 172 205 209 213 218 223 230 236 243
                                181 178 177 176 174 211 214 218 223 229
```

FIGURE 122

Wavefront Plot-P Polarization

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature-On Axis

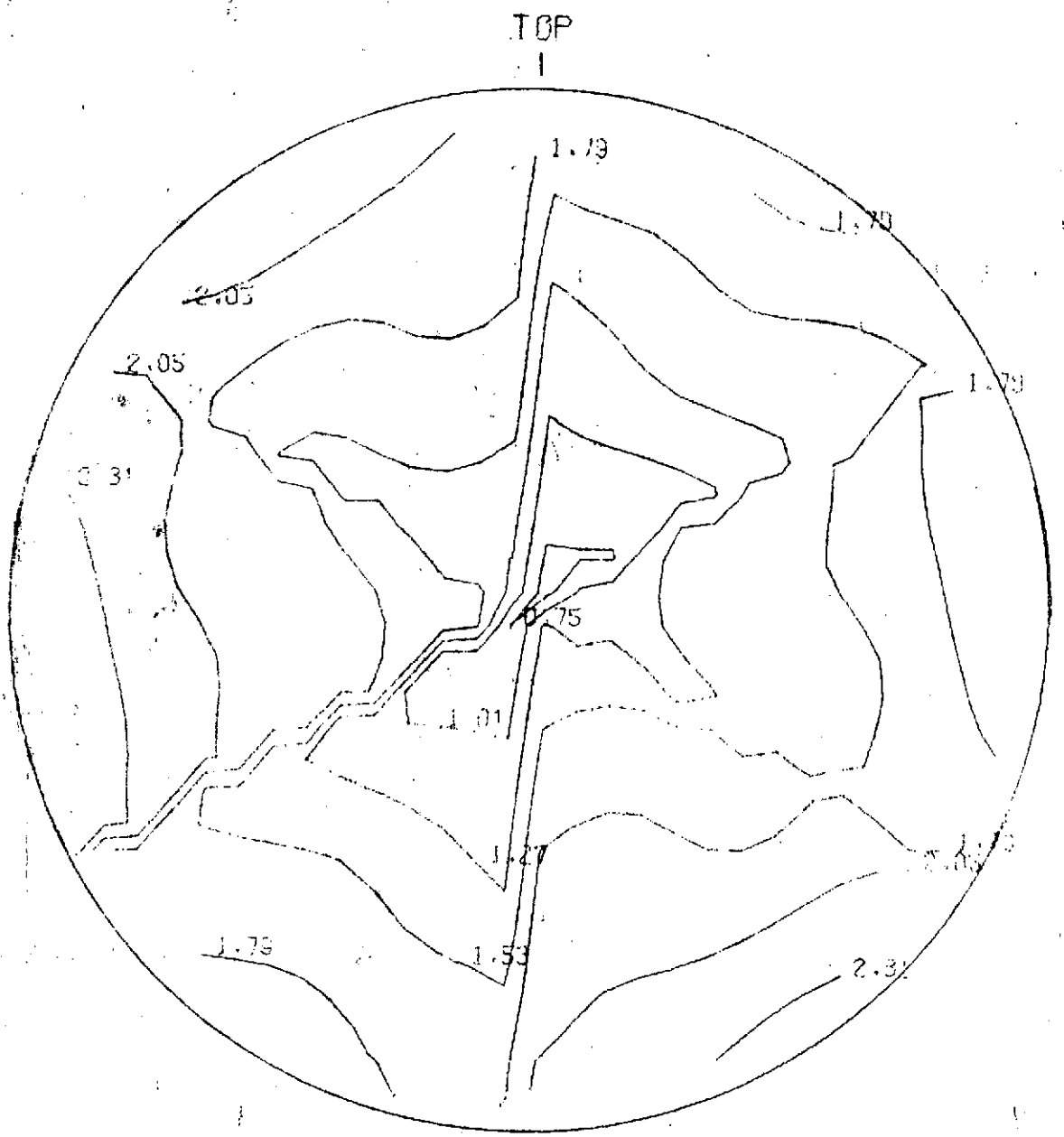


FIGURE 123

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature-On Axis

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0266 = 100
TOTAL ENERGY = 0.24610000+01
MAP REPRESENTS 0.2315136D+01 OR 94.0730 PERCENT OF TOTAL ENERGY

```
                                                
```

FIGURE 124 74

Point Spread Function

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature-On Axis

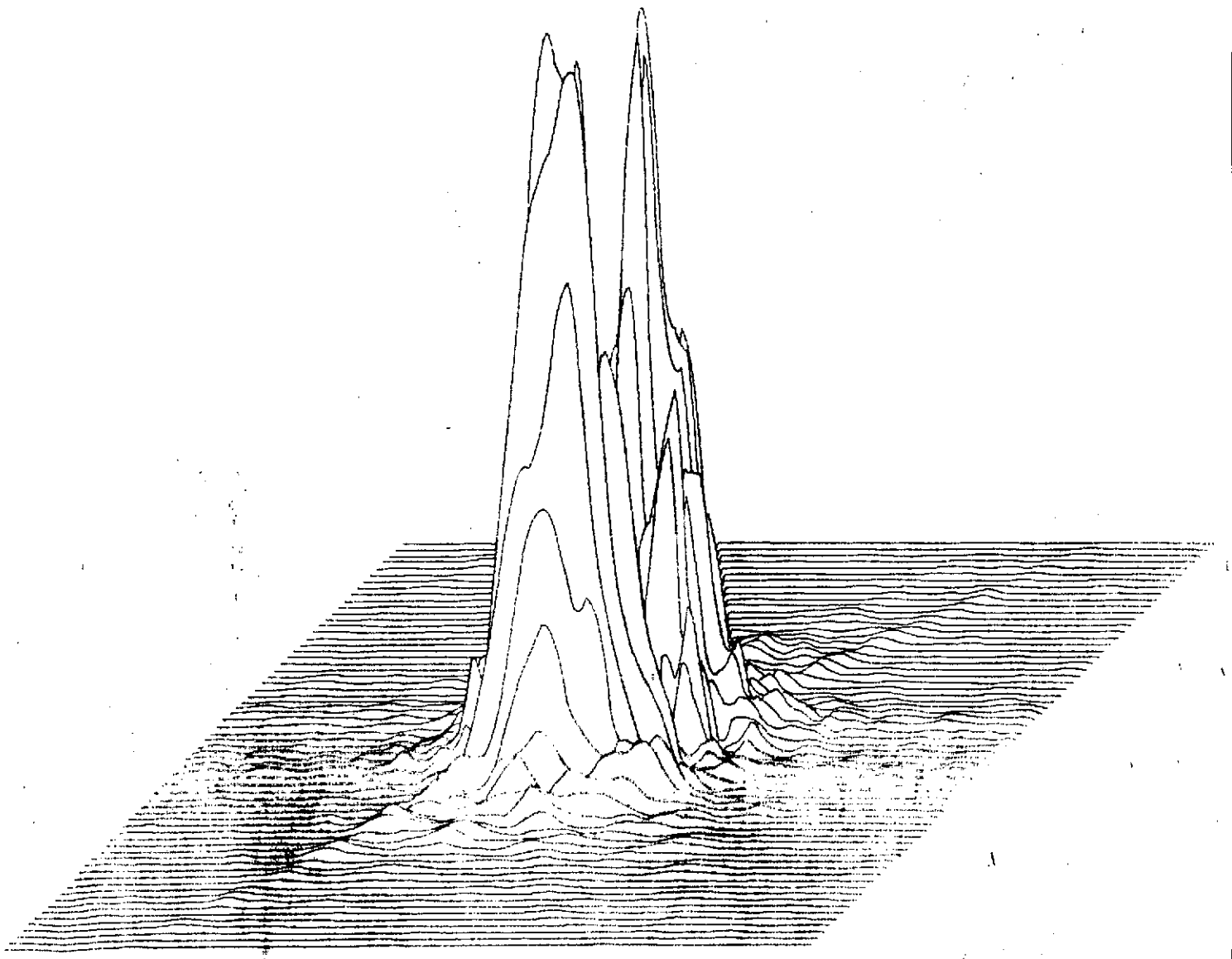


FIGURE 125

Intensity Distriubtion - Central 129 Microradians

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature-On Axis

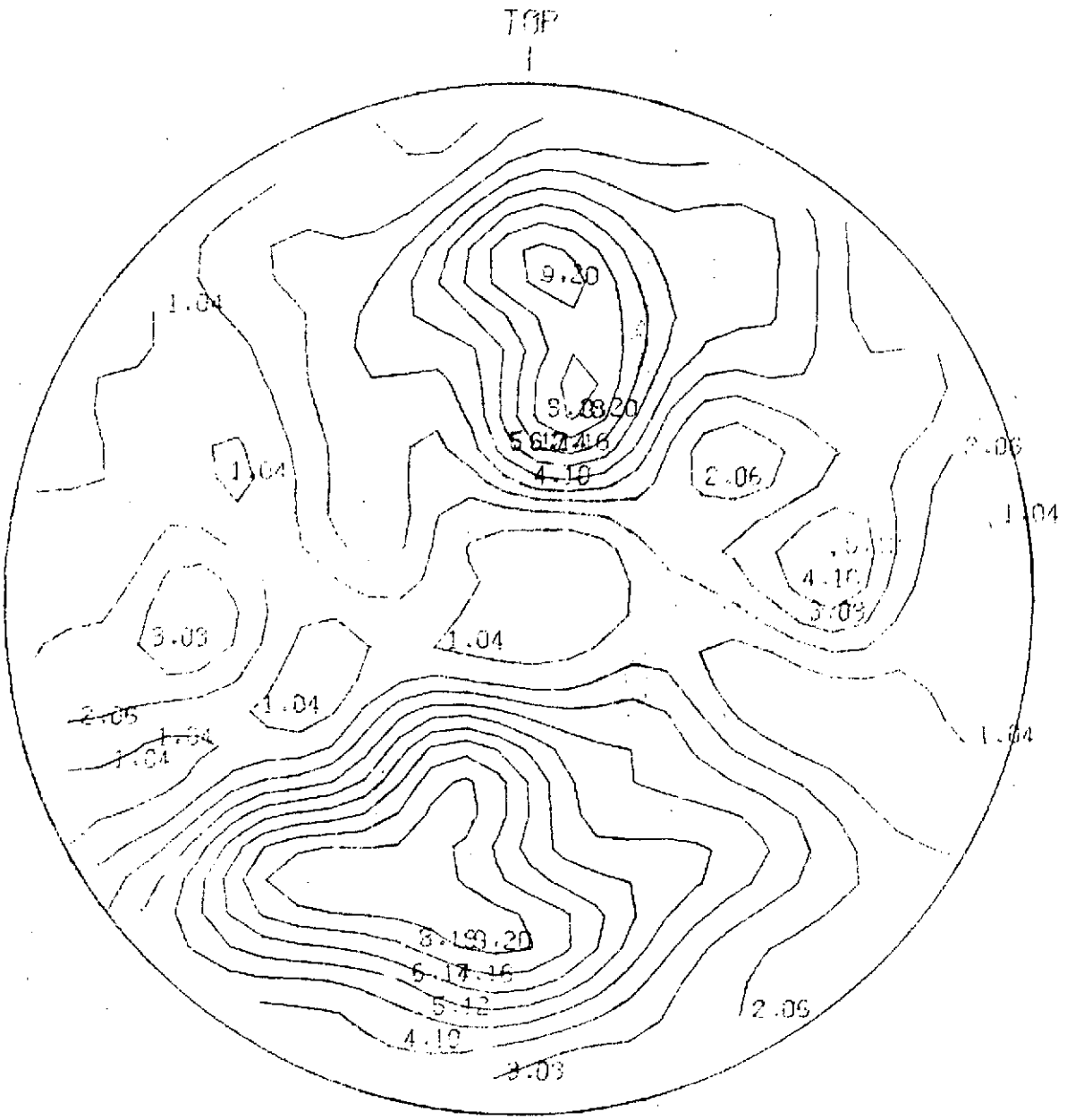


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FIGURE 126

Encircled Energy

Vs

Field Angle

Task 2.4B2 - Off Nominal Cube

+ Mfg. Error + First Temperature-On Axis

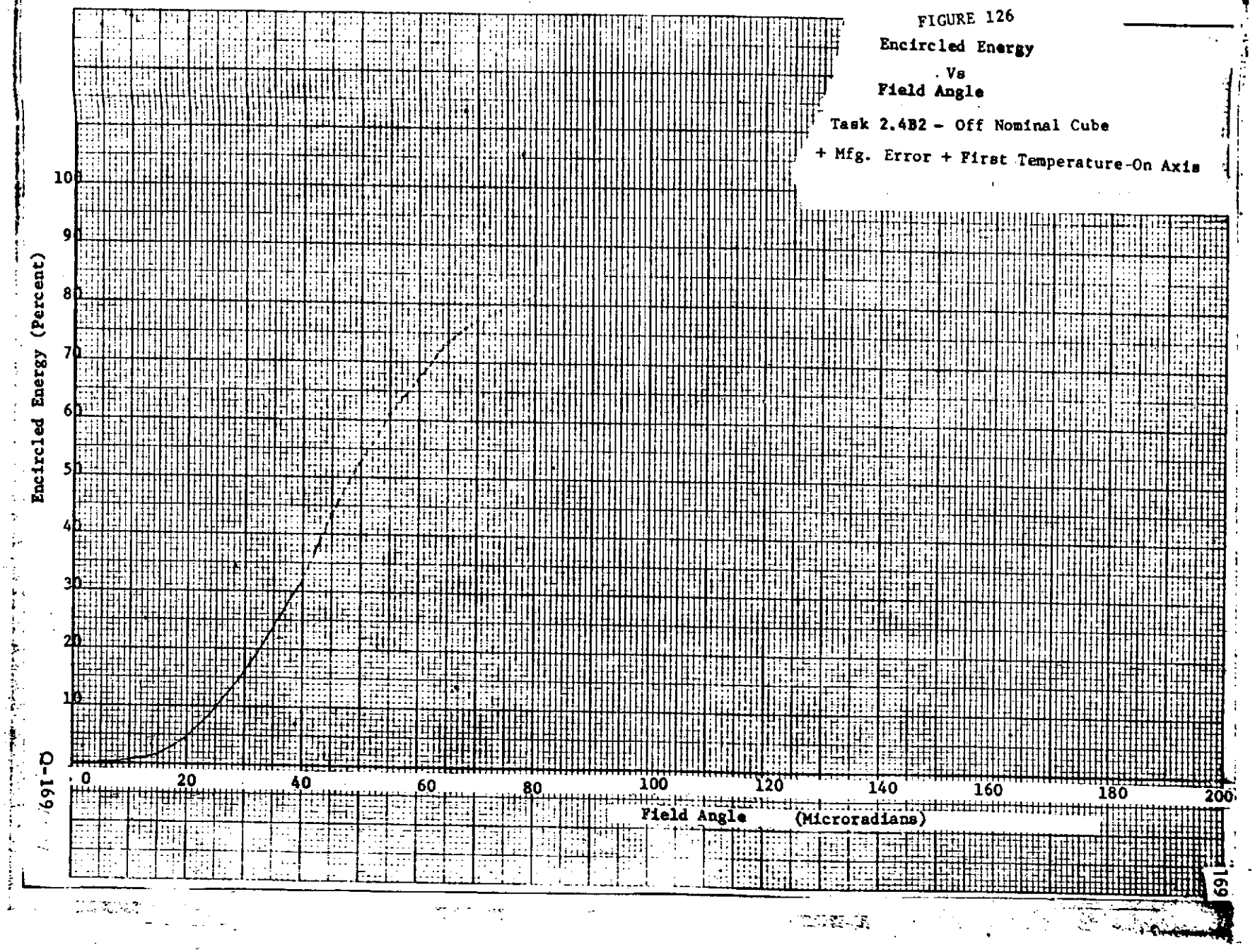

TABLE 30

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature -15° Off Axis

CIRCLE RADIUS (MILLIMICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0
4.00	0.2	0.3	0.1	0.2	0.1	0.1	0.1	0.4	0.3
6.00	0.2	0.3	0.4	0.6	1.0	0.5	0.4	0.4	0.3
8.00	0.8	1.0	0.7	1.1	1.0	1.1	0.8	1.2	1.1
10.00	1.2	1.4	1.0	1.5	1.9	1.5	1.1	1.6	1.5
12.00	2.8	3.0	1.6	2.6	2.1	2.6	1.8	3.4	3.3
14.00	2.8	3.0	2.5	3.8	2.9	3.8	3.0	3.4	3.3
16.00	4.8	5.0	3.2	5.0	3.5	5.1	3.9	5.7	5.6
18.00	5.6	5.8	4.5	6.2	5.4	6.3	5.3	6.8	6.5
20.00	7.3	7.5	5.9	8.1	5.4	8.1	7.0	8.8	8.5
22.00	8.2	8.3	8.0	9.6	8.4	9.7	9.4	9.8	9.5
24.00	10.3	10.4	9.1	10.8	10.2	10.8	10.6	12.3	11.9
26.00	11.3	11.4	11.9	12.8	13.7	12.8	13.7	13.6	13.2
28.00	13.8	13.8	14.5	15.3	14.9	15.2	16.6	16.3	15.9
30.00	15.7	15.9	17.0	17.4	18.7	17.2	19.3	18.6	18.2
32.00	19.5	19.6	19.0	19.7	21.1	19.5	21.4	22.2	21.8
34.00	20.3	20.4	22.1	22.8	23.4	22.5	24.8	23.1	22.7
36.00	24.6	24.7	24.5	25.9	26.9	25.7	27.2	27.0	26.7
38.00	26.9	27.0	27.3	28.9	30.0	28.6	29.8	29.4	29.1
40.00	30.6	30.7	30.1	32.4	32.0	32.3	32.7	32.7	32.6
42.00	32.6	32.7	33.9	36.1	35.3	36.0	36.1	34.7	34.6
44.00	36.6	36.7	35.7	38.1	38.4	38.2	38.2	38.5	38.4
46.00	39.5	39.5	40.1	41.8	42.4	42.0	42.2	41.5	41.5
48.00	42.6	42.6	43.4	45.2	44.2	45.4	45.9	44.5	44.6
50.00	45.7	45.8	46.5	47.5	48.7	47.7	48.5	47.9	48.0
52.00	48.8	49.0	49.3	50.4	52.1	50.6	51.8	51.2	51.1
54.00	50.6	50.8	53.1	53.5	55.5	53.6	55.0	53.2	53.2
56.00	54.0	54.3	56.3	57.1	58.8	57.1	58.7	56.5	56.4
58.00	56.8	57.0	58.6	59.4	62.2	59.4	60.7	59.4	59.3
60.00	59.4	59.7	61.6	62.6	65.0	62.5	64.0	61.8	61.8
62.00	61.6	61.8	64.4	65.2	67.3	65.2	66.5	64.0	64.0
64.00	65.2	65.2	66.2	67.3	69.6	67.2	68.6	66.9	67.0
66.00	67.4	67.4	69.2	69.9	71.9	69.9	71.1	69.0	69.2
68.00	69.9	69.7	71.2	71.8	72.8	71.9	72.8	70.9	71.4
70.00	71.9	71.6	73.3	73.6	74.9	73.7	74.5	72.6	73.1
72.00	74.1	73.8	74.9	75.0	76.6	75.2	75.9	74.3	74.9
74.00	75.3	74.9	76.9	76.7	78.0	76.9	77.3	75.5	76.1
76.00	77.3	76.9	78.4	78.1	79.3	78.3	78.5	77.0	77.6
78.00	78.6	78.3	79.3	79.1	80.5	79.3	79.3	78.3	78.7
80.00	79.8	79.6	80.8	80.3	81.5	80.5	80.4	79.4	79.7

ENCIRCLED ENERGY

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature -15° Off Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.2	0.3	0.4	0.4	0.6	0.4	0.4	0.4	0.3
10.00	1.2	1.4	1.0	1.5	1.9	1.5	1.1	1.6	1.5
15.00	4.0	4.2	2.9	4.6	3.5	4.6	3.4	4.8	4.6
20.00	7.3	7.5	5.9	8.1	5.4	8.1	7.0	8.8	8.5
25.00	11.0	11.1	11.5	12.4	11.4	12.4	13.3	13.1	12.8
30.00	15.7	15.9	17.0	17.4	18.7	17.2	19.3	18.6	18.2
35.00	23.0	23.1	22.8	24.0	26.0	23.7	25.3	25.4	25.0
40.00	30.6	30.7	30.1	32.4	32.0	32.3	32.7	32.7	32.6
45.00	38.0	38.0	38.6	40.3	40.0	40.5	40.6	39.9	40.0
50.00	45.7	45.8	46.5	47.5	48.7	47.7	48.5	47.9	48.0
55.00	52.9	53.1	54.3	55.0	58.1	55.1	56.6	55.3	55.2
60.00	59.4	59.7	61.6	62.6	65.0	62.5	64.0	61.8	61.8
65.00	66.1	66.1	68.2	69.0	70.6	69.0	70.2	67.8	68.0
70.00	71.9	71.6	73.3	73.6	74.9	73.7	74.5	72.6	73.1
75.00	76.6	76.2	77.5	77.3	78.8	77.5	77.9	76.4	77.0
80.00	79.8	79.6	80.8	80.3	81.5	80.5	80.4	79.4	79.7
85.00	82.1	82.0	83.1	82.8	83.5	82.8	82.7	81.9	81.9
90.00	83.9	84.0	84.5	84.5	84.9	84.4	84.4	83.9	83.8
95.00	85.4	85.5	85.6	85.7	85.9	85.7	85.7	85.6	85.4
100.00	86.5	86.6	86.6	86.7	86.8	86.7	86.8	86.7	86.6
105.00	87.4	87.5	87.6	87.6	87.8	87.7	87.7	87.6	87.5
110.00	88.3	88.4	88.5	88.4	88.6	88.5	88.5	88.4	88.4
115.00	89.2	89.2	89.3	89.2	89.3	89.2	89.2	89.1	89.2
120.00	89.9	89.9	89.9	89.9	90.1	89.9	89.9	89.7	89.8
125.00	90.5	90.5	90.6	90.5	90.7	90.5	90.5	90.3	90.3
130.00	91.0	91.0	91.1	91.1	91.2	91.1	91.0	90.9	90.9
135.00	91.4	91.4	91.4	91.5	91.5	91.5	91.5	91.5	91.5
140.00	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9
145.00	92.3	92.3	92.3	92.3	92.2	92.3	92.3	92.2	92.2
150.00	92.7	92.7	92.7	92.7	92.7	92.6	92.6	92.6	92.6
155.00	93.0	93.0	93.1	93.0	93.1	93.0	93.0	93.0	93.0
160.00	93.4	93.4	93.4	93.4	93.4	93.4	93.4	93.4	93.4
165.00	93.8	93.7	93.8	93.8	93.8	93.8	93.8	93.8	93.8
170.00	94.1	94.0	94.1	94.2	94.2	94.2	94.1	94.1	94.1
175.00	94.4	94.4	94.4	94.4	94.5	94.4	94.4	94.4	94.4
180.00	94.7	94.7	94.7	94.7	94.8	94.7	94.8	94.7	94.7
184.99	95.0	95.0	95.0	94.9	94.9	95.0	95.0	95.0	95.0
189.99	95.2	95.3	95.3	95.2	95.3	95.3	95.3	95.2	95.2
194.99	95.5	95.5	95.6	95.5	95.6	95.5	95.5	95.5	95.4
199.99	95.8	95.8	95.8	95.8	95.8	95.8	95.8	95.8	95.7

FIGURE 127

Wavefront Map-() Polarization

Task 2.482 - Off Nominal Cube + Mfg. Error + First Temperature -15° Off Axis

MAP IN UNITS OF 0.01 WAVES

195 188 195 199

230 220 209 200 191 185 191 196 201 206 211 216

240 233 225 216 206 196 188 183 189 194 199 205 210 216 222 227

236 232 226 218 210 200 192 184 179 185 190 196 202 208 214 220 225 231

228 228 226 223 218 211 203 194 186 179 175 180 185 191 197 203 209 215 221 227 233 238

218 218 218 217 214 210 203 196 188 181 174 170 175 179 185 190 196 203 209 215 221 227 233 239

210 211 211 210 207 203 197 190 183 176 170 165 169 174 179 184 190 196 202 208 214 220 226 233

202 197 193 205 204 202 197 192 185 179 172 166 161 164 168 173 178 183 189 195 201 208 214 204 212 220

211 206 202 197 192 186 197 193 187 181 175 169 162 157 159 163 167 172 177 182 188 195 186 195 204 211 219 226

215 210 206 201 196 186 181 174 166 178 172 165 159 153 155 158 162 166 171 160 168 178 187 196 204 211 218 224

222 218 214 209 204 198 191 183 174 166 158 151 161 155 149 150 153 157 145 153 161 170 180 189 197 205 211 218 223 228

225 221 216 211 205 199 191 182 173 165 157 149 142 135 144 144 133 140 148 156 164 172 181 190 198 205 211 217 222 226

227 222 217 211 205 198 190 181 171 163 155 147 139 150 147 147 153 143 150 158 166 174 183 191 199 205 210 215 220 224

224 218 211 204 197 188 179 169 160 152 164 159 155 152 151 157 163 169 159 166 174 182 190 197 203 208 212 217

225 218 211 204 196 187 177 168 179 174 169 165 160 157 155 161 167 173 179 185 173 181 188 194 200 204 209 213

219 212 204 195 204 198 191 185 179 174 170 165 161 158 164 170 177 183 189 195 189 202 190 195 200 204

221 213 223 217 211 204 198 192 186 180 176 171 166 162 168 174 180 187 194 200 204 206 207 207 195 200

235 229 223 217 211 205 199 193 187 181 176 172 167 172 178 185 193 200 206 210 213 214 214 213

235 229 223 218 212 206 199 193 187 182 177 172 177 183 191 199 207 213 218 221 222 222

235 229 223 217 211 205 199 193 188 183 177 182 189 197 206 214 221 227 231 232

232 226 221 215 209 203 197 197 187 181 186 194 203 212 221 229 236 240

222 216 211 205 200 195 190 184 190 198 208 218 227 236

211 206 202 197 192 186 192 201 211 221

FIGURE 128

Wavefront Plot-Q Polarization

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature -15° Off Axis

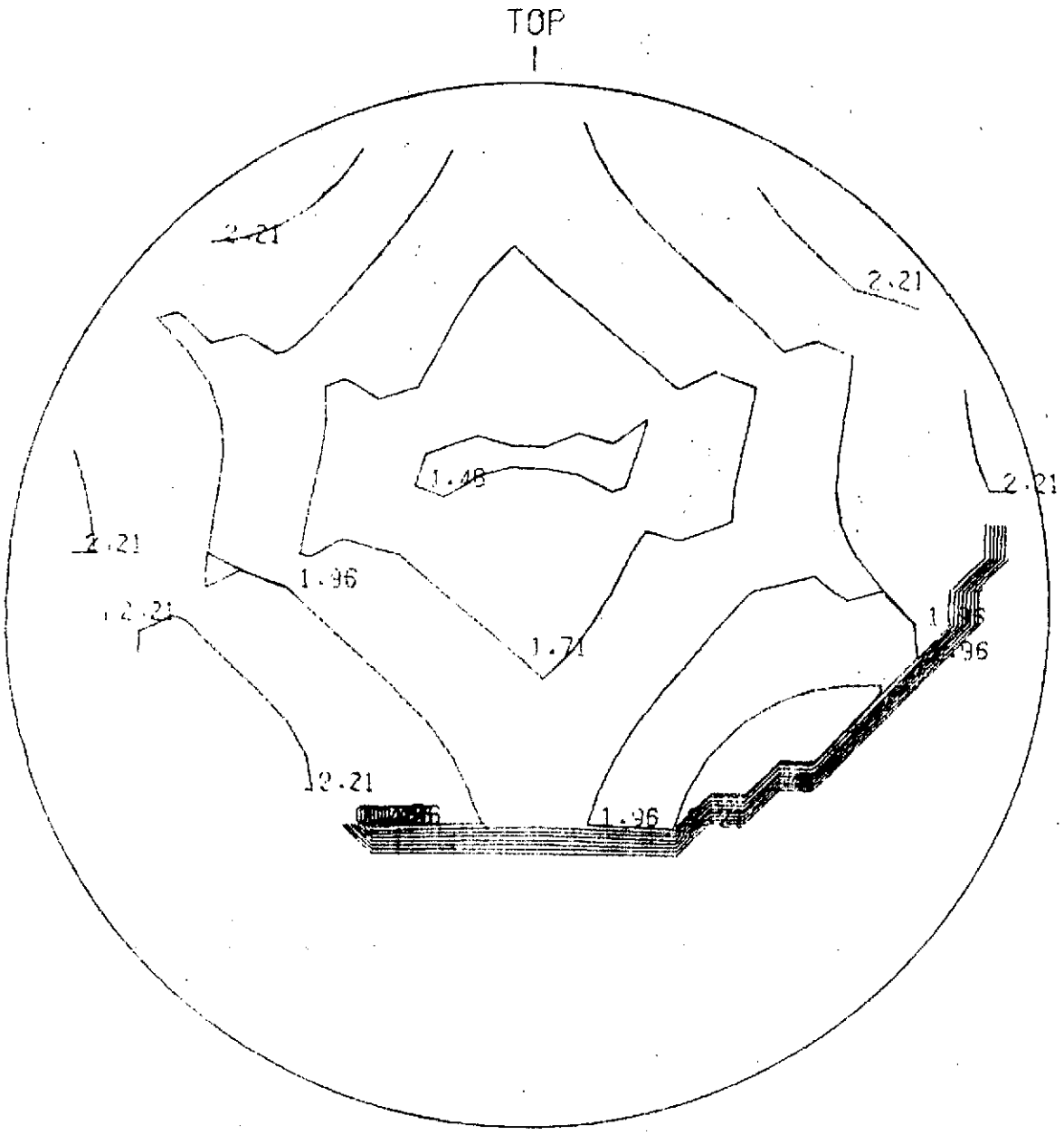

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FIGURE 129

Wavefront Map-P Polarization

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature -15° Off Axis

MAP IN UNITS OF 0.01 WAVES

```
                                                  164 158 114 118
                                        199 189 179 169 161 154 111 115 120 125 131 136
                                    209 203 194 185 175 166 158 152 108 113 119 124 130 135 141 147
                                205 201 195 188 179 170 161 154 149 105 110 115 121 127 133 139 145 150
                            198 197 196 192 187 180 172 164 156 149 144 100 105 110 116 122 128 134 140 146 152 158
                        187 188 188 187 184 179 173 166 158 150 144 139  94  99 104 110 116 122 128 134 140 146 152 158
                        179 180 180 179 177 172 166 160 152 145 139 134  89  93  98 103 109 115 121 128 133 140 146 152
                    218 214 209 175 174 171 167 161 155 148 142 135 130  84  88  92  97 103 108 114 121 127 133 171 179 187
                227 223 218 214 209 202 166 162 157 151 145 138 132 126  79  83  87  91  96 102 108 114 153 162 170 178 186 193
                231 227 223 218 212 206 168 190 183 147 141 135 129 123  74  78  82  86  91 126 135 145 154 163 171 178 185 191
            239 235 230 226 221 215 207 159 191 183 175 168 131 125 119  69  73  76 112 120 128 137 146 156 164 172 178 184 190 195
            242 237 233 228 222 215 207 199 190 181 174 166 158 151 114  64 100 107 115 123 131 139 148 157 165 172 178 184 189 193
            244 239 234 228 222 215 206 197 188 179 171 163 156  79  76 126 132 110 117 125 132 141 150 158 165 172 177 182 187 191
            240 234 228 221 213 205 195 186 177 169  92  88  84  81 130 136 142 148 126 133 141 149 157 164 170 175 179 183
            241 235 228 220 212 203 194 185 176 103  98  93  89  86 134 140 146 152 158 164 140 147 155 161 166 171 175 180
                236 228 220 212 133 127 120 114 108 103  99  94  90 137 143 149 155 162 168 174 178 180 157 162 167 171
            237 229 152 146 139 133 127 121 115 109 104 100  95 141 146 153 159 166 173 179 183 185 186 186 162 167
                164 158 152 146 140 134 128 122 116 110 105 101 146 151 157 164 171 179 185 189 152 193 193 192
                    164 158 152 147 141 134 128 122 116 111 106 151 155 162 170 178 185 192 197 200 201 201
                        164 158 152 146 140 134 128 122 116 111 156 161 168 176 185 193 200 206 209 211
                            161 155 150 144 138 132 126 121 116 160 165 173 182 191 200 208 215 219
                                151 145 140 134 129 124 119 163 169 177 186 196 206 215
                                    140 135 130 126 121 165 171 180 190 200
```

FIGURE 130

Wavefront Plot-P Polarization

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature -15° Off Axis

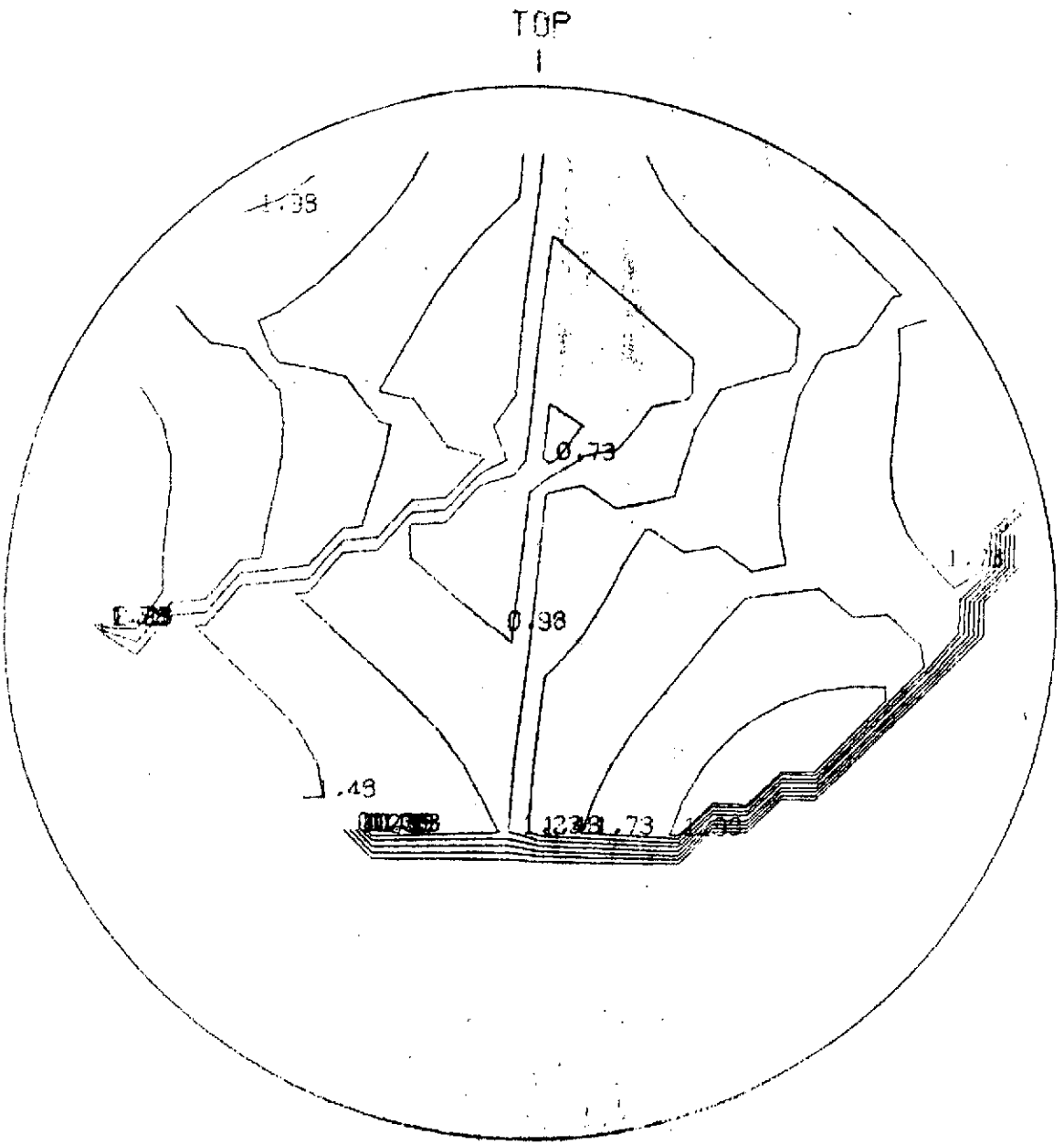

FIGURE 131

Task 2.432 - Off Nominal Cube + Mfg. Error + First Temperature -15° Off Axis

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0171 = 100
TOTAL ENERGY = 0.18704000+01
MAP REPRESENTS 0.17432000+01 OR 93.1993 PERCENT OF TOTAL ENERGY

```
 0  0  0  0  0  1  1  1  1  0  0  0  0  1  0  0  0  0  0  0  0  0  1  1  0  0  0  1  1  1  0  0  0  0  0
 0  0  0  1  1  1  1  1  1  0  0  0  0  1  1  1  1  1  0  1  1  1  1  1  0  1  1  0  1  1  1  1  0  0  0  0
 0  0  0  1  1  1  1  1  1  1  1  1  1  0  0  1  1  1  2  2  1  1  3  3  1  1  1  0  1  1  1  1  1  1  0  0  0  0
 0  0  0  0  1  1  1  1  1  1  1  1  1  0  0  1  2  3  2  2  4  2  1  1  1  1  1  1  1  1  1  1  0  0  0  0  0
 0  0  0  0  0  1  1  1  0  1  2  1  0  0  0  2  2  2  3  3  1  0  1  0  1  1  1  1  2  1  0  0  0  0  0  0
 0  0  0  0  0  0  0  1  1  1  2  2  1  1  1  0  1  1  1  2  3  1  1  1  0  1  1  1  1  1  0  0  0  1  1  0
 1  0  1  0  1  1  2  2  2  2  1  2  3  1  1  3  3  2  3  5  4  1  1  1  1  2  2  2  1  0  1  0  1  1  0  0
 1  1  0  0  1  2  2  2  2  3  2  3  3  2  4  7  6  6  5  8  8  3  1  3  3  2  2  2  1  0  1  0  1  1  1  0
 0  0  0  0  1  1  2  2  3  4  4  5  5  6  8  7  7  9  7  8 10  7  7  6  4  2  2  2  1  0  0  0  0  1  0  0
 0  0  0  1  1  1  2  2  3  4  4  6  8 11  9  5  7  9  7  7  8 10 13 10  5  3  3  1  1  1  0  0  0  0  0  0
 1  1  0  1  0  1  2  1  1  3  6  8 12 15 11  9  9  7 10 15 12 12 13 11  7  3  1  1  1  2  1  0  0  1  1  0
 1  1  1  1  1  2  3  2  4  9 11 12 21 27 23 23 16  4 13 25 25 26 21 16 15  6  1  1  1  3  3  1  1  1  1  0
 1  2  2  2  2  3  3  6 12 18 16 21 40 45 40 41 27  8 15 27 35 50 43 26 24 14  4  2  2  4  4  3  1  1  1  0
 1  2  2  2  2  2  3  8 16 18 18 35 55 47 46 51 30 13 21 32 42 64 61 36 26 16  6  3  1  3  3  3  1  1  1  0
 1  2  2  1  1  2  4  8 12 16 27 54 60 38 49 54 20  8 26 51 58 60 63 46 29 15  6  3  2  3  3  2  1  1  2  0
 2  2  1  1  2  4  6  7 10 20 39 62 52 36 67 57 12 10 26 63 76 50 55 59 40 20  8  4  4  5  3  2  2  2  2  0
 1  1  1  1  3  4  5  4  7 18 31 40 28 35 79 56 22 38 28 54 76 37 34 51 38 21 10  4  3  3  2  1  1  1  1  0
 0  0  0  1  1  1  1  2  5  9 10  8  5 27 69 46 33 59 32 44 67 23  7 18 16 13  9  3  0  0  1  1  0  0  0  0
 1  0  1  1  1  1  1  4  5  5  3  6 17 38 70 55 33 38 30 58 74 32 11  5  0  6  8  5  3  1  1  1  1  1  0  0
 1  1  1  2  2  2  2  5  5  5 11 29 58 74 91 83 38  9 30 81 87 62 55 31  7  4  6  6  5  3  2  1  1  1  1  0
 0  0  1  1  1  2  2  3  2  5 18 47 89100 94 86 43  8 35 79 80 84 91 55 17  5  3  4  4  3  1  1  1  1  1  0
 0  0  1  1  1  2  2  2  1  9 28 57 93 96 67 49 29 15 32 52 59 81 88 54 26 14  6  3  2  2  1  1  1  0  0  0
 1  1  1  1  1  2  2  2  3 14 40 60 75 72 45 21  9 10 20 30 43 62 62 45 35 25 11  4  2  1  1  1  1  1  0  0
 0  1  1  1  1  2  2  1  2 11 33 45 43 40 34 21  8  6 13 23 33 37 34 32 30 20  9  4  2  1  0  1  1  0  0  0
 0  0  0  0  0  1  1  0  0  3 12 18 15 13 19 21 14  9 12 19 19 14 13 14 11  5  2  3  2  0  0  1  0  0  0  0
 0  0  0  0  0  1  1  0  1  1  1  3  5  3  5 11 13 11  9  9  7  4  4  2  0  1  0  1  1  0  0  0  0  0  0  0
 0  0  0  0  0  0  1  1  1  1  2  2  2  4  4  3  5 10 10  6  4  3  3  3  2  3  4  1  1  1  0  0  0  0  0  0  0
 0  0  1  0  0  0  2  3  3  4  3  2  3  6  7  6  7  6  4  2  2  3  4  5  5  3  3  3  1  0  0  0  0  0  0  0
 0  0  1  0  0  0  1  4  5  3  3  3  1  2  8  8  3  3  5  4  1  1  3  3  4  5  5  5  3  1  0  0  0  0  0  0  0
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 0  0  0  0  1  2  2  1  1  1  0  0  1  1  1  1  1  0  1  1  1  1  0  0  0  1  1  2  3  2  1  1  0  0  0  0  0
 0  0  0  0  0  1  2  1  0  0  0  1  2  1  1  0  0  0  1  1  1  1  1  0  0  1  1  2  2  1  0  0  0  0  0  0  0
10
10
```

FIGURE 132

Point Spread Function

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature -15° Off Axis

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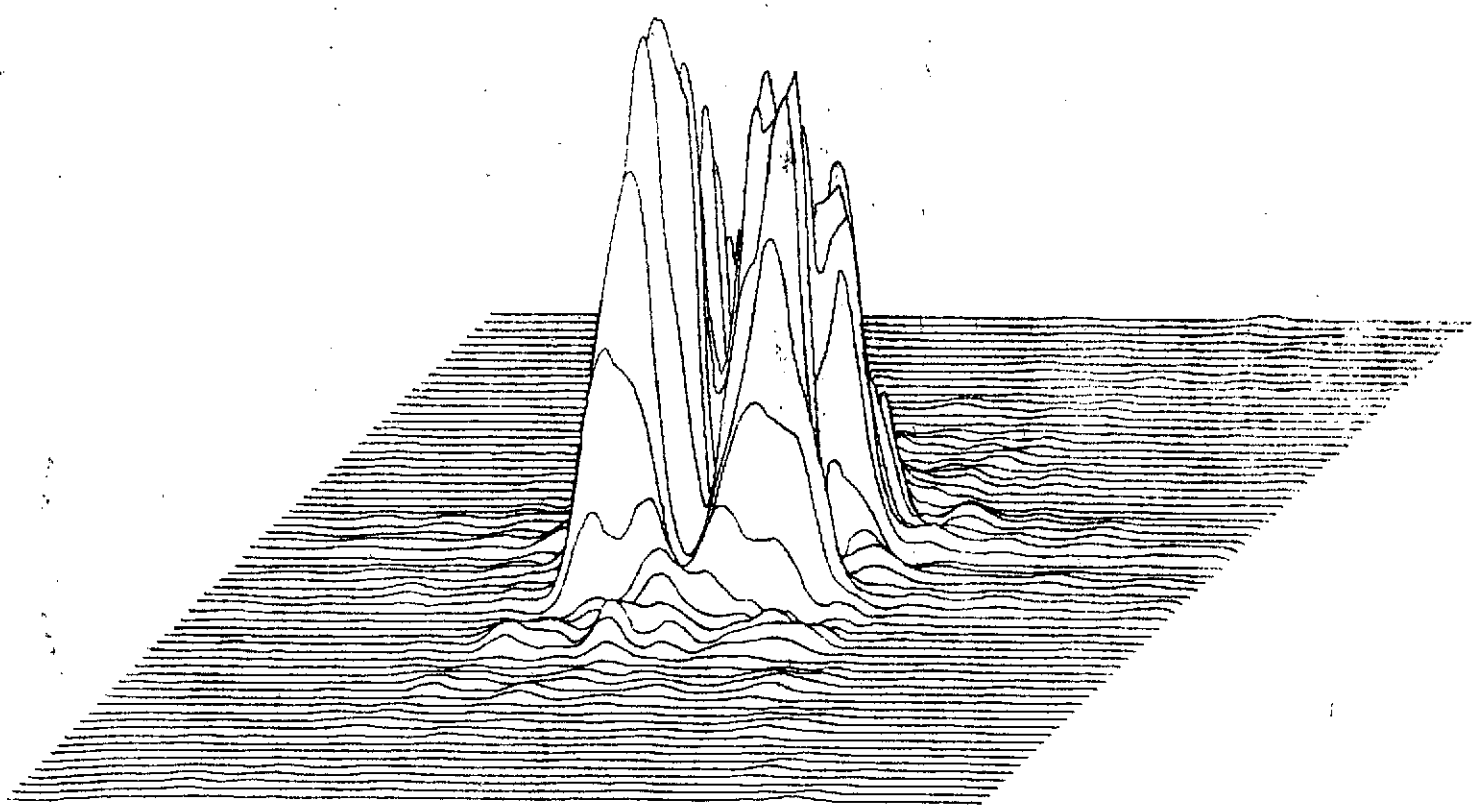

FIGURE 133

Intensity Distriubtion - Central 129 Microradians

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature -15° Off Axis

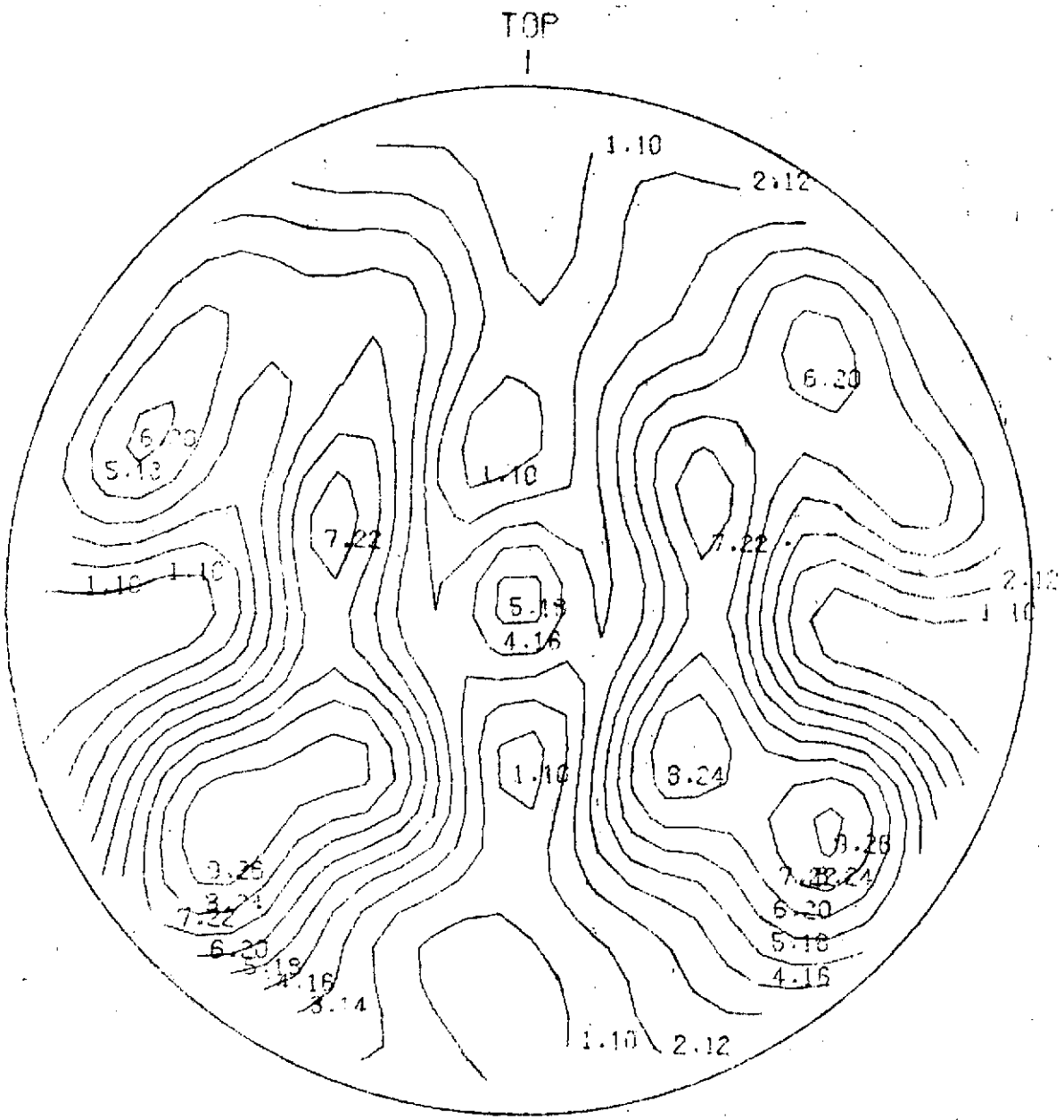

FIGURE 134

Encircled Energy

Vs

Field Angle

Task 2.4B2 - Off Nominal Cube

+ Mfg. Error + First Temperature -15° Off Axis

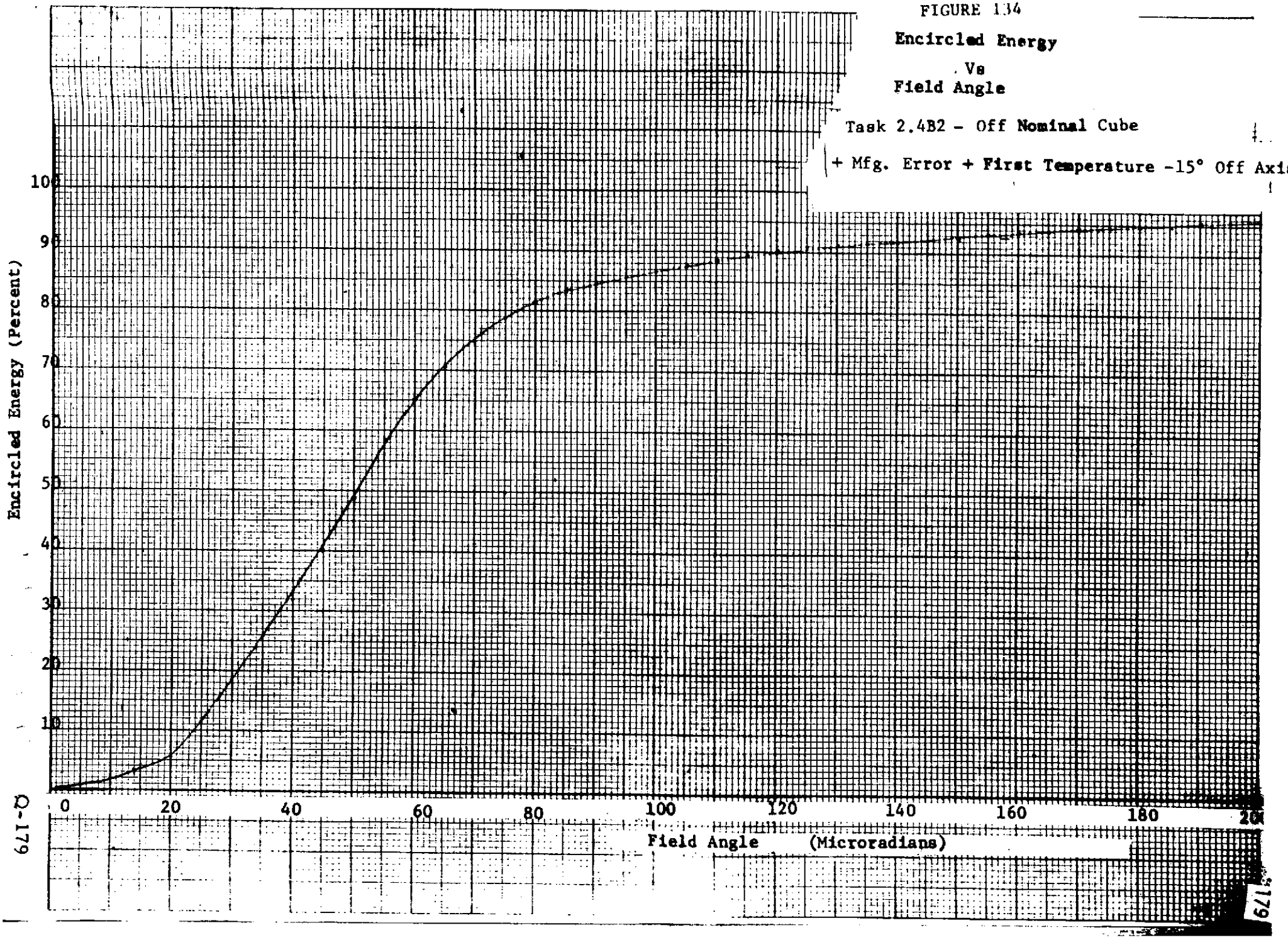

TABLE 32

Encircled Energy in the

32-42 Microradian Range

Task	Case	Percent Energy 32-42 Microradians	
		On Axis	-15* *
2.1	Nominal Cube	21.6	10.8
2.2	Nominal Cube +λ/4	21.2	9.8
2.3B	Nominal Cube +λ/4 + Temp 1	20.4	9.4
2.3A1	Nominal Cube +λ/4 + Temp 2	21.1	
2.3A2	Nominal Cube +λ/4 + Temp 3	20.2	
2.4A	Off Nominal Cube +λ/4	20.8	9.8
2.4B2	Off Nominal Cube +λ/4 + Temp 1	20.0	9.2
2.5A	Nominal Cube +λ/4 + Axial Grad.	18.0	
2.5B	Nominal Cube +λ/4 + Radial Grad.	5.1	

* values shown have been multiplied by 65% as per text.

TABLE 33

One Sigma Error Sources in Calculation
of Encircled Energy and
Point Spread Function

Error Source/Parameter	Point Spread Function	Encircled Energy
N3D, Thermal Phase Error ≈ 0.01λ	0.02%	0.004%
Polarization ~ 0.0002λRMS	~0	~0
Fourier Transform Point Spread Function	5%	0.4%
Intergration (finite grid)	—	1%
RSSed Total	~ 5%	~ 1.1%

Table 34
Corner Cube Study
Selected Computer Code Abstracts

(Note: All codes may be executed sequentially in various combinations in a single computer run; no's 4-5 can provide data in both printed and plotted output format, e.g. 3-D or contour OPD maps)

No.	Name	Function	Computer	Mathematical Process	Input	Output
1	CLIC/SAVE-FIND	Optical geometry and refractive index (N) input	IBM 370, 158	Puts data into computer storage, calls it as necessary	Optical geometry*, N vs. Wavelength (λ)*, SAVE/FIND commands	Echo Print
2	THRM/N3D	Input of temp. (T), material properties, and thermo-optical geometry	IBM 370, 158	Transform optical geometry and indicies into perturbed state in storage	Expansion coefficients; temperature coefficients of N (λ,T); atmospheric data such as pressures, relative humidities, etc.*; T (X,Y,Z)*; thermo-optical geometry*, output of No.1	New Optical geometry $N(\lambda,X,Y,Z)$
3	ZINT	Raytracing	IBM 370, 158	Three dimensional raytracing, stores optical path differences (OPD's) on a user specified grid for field angles of interest ($\bar{H}$)	Output of No. 2, grid and raytracing specifications	OPD ($\bar{H}$,X',Y',Z')
4	FRED	Specification of unusual apertures	IBM 370, 158	Scaling and weighting of OPD's on desired grids	Output of No's 2 and 3, aperture geometry*, OPD generation commands	New OPD Map
5	POINT	Diffraction computations	IBM 370, 158	New OPD's used to get normalized point spread function, PSF (Int. - I vs. X",Y",Z"), through fourier transform	Output of No. 4, I scale commands	Normalized PSF, i.e. I ($\bar{H}$,X",Y", Z").
6.	ENEN	Encircled Energy	IBM 370,158	Intensity distribution used to obtain encircled energy in desired inclements, spline interpolation of intensity used for increased accuracy	Output of No. 5	Encircled energy vs. radius

APPENDIX A

EFFECTS OF BEVELED EDGES

When the effects of the beveled edges are included, the analysis becomes more interesting. To begin with these ground-down edges do not exactly result in a pupil function with simple spoked obstructions. Fortunately, these are small, high order effects, and the spoked obstruction can be assumed to lie in the plane of the diffracting aperture. (For non-Normal incidence the angles between the spokes, and their apparent location in the aperture, will vary with the incident beam angle, a case which is not considered here).

If the general form of Kirchhoff's diffraction integral is examined, it will be seen that the complex amplitude at P, i.e., U(P), for a circular aperture with obstructing spokes in it, is just the complex amplitude due to integrating over the unobstructed aperture minus the complex amplitude U(P) due to integrating over the area of the obstructions alone. The desired amplitude U(P) can thus be written as

$$U(P)_{total} = U(P)_{circle} - U(P)_{obstructions}$$

$U(P)_{circle}$ can be given by, $C\left[\frac{2J_1(v)}{v}\right]$ and $U(P)_{obstructions}$ is readily obtained. The three full-diameter spoked obstructions are situated at $\theta = \theta^{o}$, $\theta = 60^{o}$, and $\theta = 120^{o}$. If the small curvature at the ends of each spoke, due to the circular aperture, is ignored, then each of the three obstructions is a thin rectangle of length 2a (the diameter of the cube corner) and width w (some small number). If the small common area at their intersection in the center of the aperture is ignored, then the effect of one spoke can be evaluated, and then summed three times to get the total effect of the obstructions.

The amplitude U(P) due to a single rectangle of length 2a and width w is well known and easy to calculate:

$$U(P) \propto \frac{\sin(\frac{2\pi}{\lambda} \cdot 2a \cdot \sin\psi_a)}{(\frac{2\pi}{\lambda} \cdot 2a \cdot \sin\psi_a)} \cdot \frac{\sin(\frac{2\pi}{\lambda} \cdot w \cdot \sin\psi_w)}{(\frac{2\pi}{\lambda} \cdot w \cdot \sin\psi_w)}$$

where ψ_a and ψ_w are the components of the angle ψ, which are normal to the length and width of the rectangle. Assuming that $\sin\psi \simeq \psi$, this simplifie to

$$U(P)_{rectangle} \propto \frac{\sin(2va)}{2va} \cdot \frac{\sin(\frac{wv_w}{a})}{\frac{wv_w}{a}}$$

If the proportionality constant is determined and the effects of the three spokes in the appropriate orientations are successively subtracted away from $U(P)_{circle}$, the final result obtained for the obstructed aperture is

$$U(P)_{total} = U(P)_{circle} - U(P)_{obstructions}$$

$$= -\frac{\sqrt{\pi a^2 E_{circle}}}{\lambda}\left[\frac{2J_1(v)}{v}\right] - \frac{\sqrt{2awE_{obs}}}{\lambda}\left[\frac{\sin(2v\cos\theta)}{2v\cos\theta} \cdot \frac{\sin(\frac{w}{a} v \sin\theta)}{\frac{w}{a} v \sin\theta}\right.$$

$$+ \frac{\sin 2v\cos(\theta-60^\circ)}{2v\cos(\theta-60^\circ)} \cdot \frac{\sin\left[\frac{w}{a} v \sin(\theta-60^\circ)\right]}{\frac{w}{a} v \sin(\theta-60^\circ)} + \frac{\sin 2v\cos(\theta+60^\circ)}{2v\cos(\theta+60^\circ)} \cdot$$

$$\left.\frac{\sin\left[\frac{wv}{a}\sin(\theta+60^\circ)\right]}{\frac{wv}{a}\sin(\theta+60^\circ)}\right]$$

where $v\cos\theta$ and $v\sin\theta$ define the angular position of the observation point P relative to the coordinate system that has been set up in the entrance face of the cube corner. The second, third, and fourth terms above represent the effects of the three thin rectangular obstructions in the aperture, while E_{obs} is the

energy intercepted by each one. One can easily show that, for rectangles much thinner than their length ($w \ll 2a$), as is the case here, each of the last three terms above becomes signifcant only in the immediate vicinity of the respective angles of $\theta = 90^\circ$, $\theta = 150^\circ$ and $\theta = 30^\circ$, in which case the other terms can be neglected. Therefore at $\theta = 90^\circ$

$$U(P) = \frac{\sqrt{\pi a^2 E_{circle}}}{\lambda}\left[\frac{2J_1(v)}{v}\right] - \frac{\sqrt{2awE_{obs}}}{\lambda}\left[\frac{\sin(\frac{w}{a}v)}{\frac{w}{a}v}\right]$$

with the same result in the immediate vicinity of $\theta = 150^\circ$ and $\theta = 30^\circ$. For values of θ away from these values, the effect of the obscurations is negligible and only the Airy pattern term remains. The intensity at P is just the square of U(P) as given above.

The function $\frac{\sin x}{x}$ behaves very much like $\frac{2J_1(x)}{x}$. The latter damps out very quickly, as in the Airy pattern, where after a few rings away from the Airy disk, the intensity is very low. The factor

$$\frac{\sin\left(\frac{wv}{a}\right)}{\frac{wv}{a}}$$

will, therefore, damp out about the same way as $\frac{2J_1(v)}{v}$ does, but since $\frac{w}{2a}$ (width/length) of the spokes is a very small number, a much larger value of v will be required to damp out the spoke effects to the same degree. The effect can be seen in Figure A-1, which shows how each of the three full diameter rectangular obstructions (due to the beveled edges) gives rise to a narrow fan of light, extending far out into the region where the bright rings of the Airy pattern are too dim to be visible on the plot. These fans are oriented, as mentioned above, at right angles to the long direction of the rectangles which caused them.

Since the intensity I(P) is the square of U(P), the Airy pattern term and the rectangle term due to the spokes will interact in the squaring and give a cross product term. However, the rectangle term is much smaller than the Airy term, due to the small relative amount of energy E_{obs} intercepted by the obstruction, and the square of the rectangle term can be ignored and just the cross product retained. Therefore, the result is that

$$I(P) = \frac{\pi a^2 E_{circle}}{\lambda^2}\left[\frac{2J_1(v)}{v}\right]^2 - \frac{\sqrt{8\pi\, a^3 w E_c E_{obs}}}{\lambda^2}\left[\frac{2J_1(v)}{v}\right]\frac{\sin(\frac{w}{a}v)}{\frac{w}{a}v}$$

in the vicinity of $\theta = 90^\circ$ or $\pm 30^\circ$, with the second term negligble at other values of θ. The effect of the slowly decaying rectangle term, is to slowly modulate the amplitude of the Airy pattern in a highly angularily dependent manner. That is why the light fans shooting out in the plot go through maxima along their lengths; they represent narrow angular corridors through the Airy ring pattern, given a high local "magnification by the rectangle term above. Note that these results apply equally well to perfect cat's-eye retro-reflectors having radial struts, spider supports, etc.

The diffraction pattern of Figure A1 is plotted for a circular aperture where the three spoked obstructions had a length to width ratio of about 13 to 1, much smaller than for the ground edges of an actual cube corner. The latter case produced effects too weak compared to the central maximum of the Airy disk to show up well on the plot. The peak intensity in the actual cube was found to be reduced by 1.7% due to obstructions as compared with a perfect cube corner.

It is worth noting that the approximate expression given for the airy diffracting pattern for regions away from the central maximum can also be

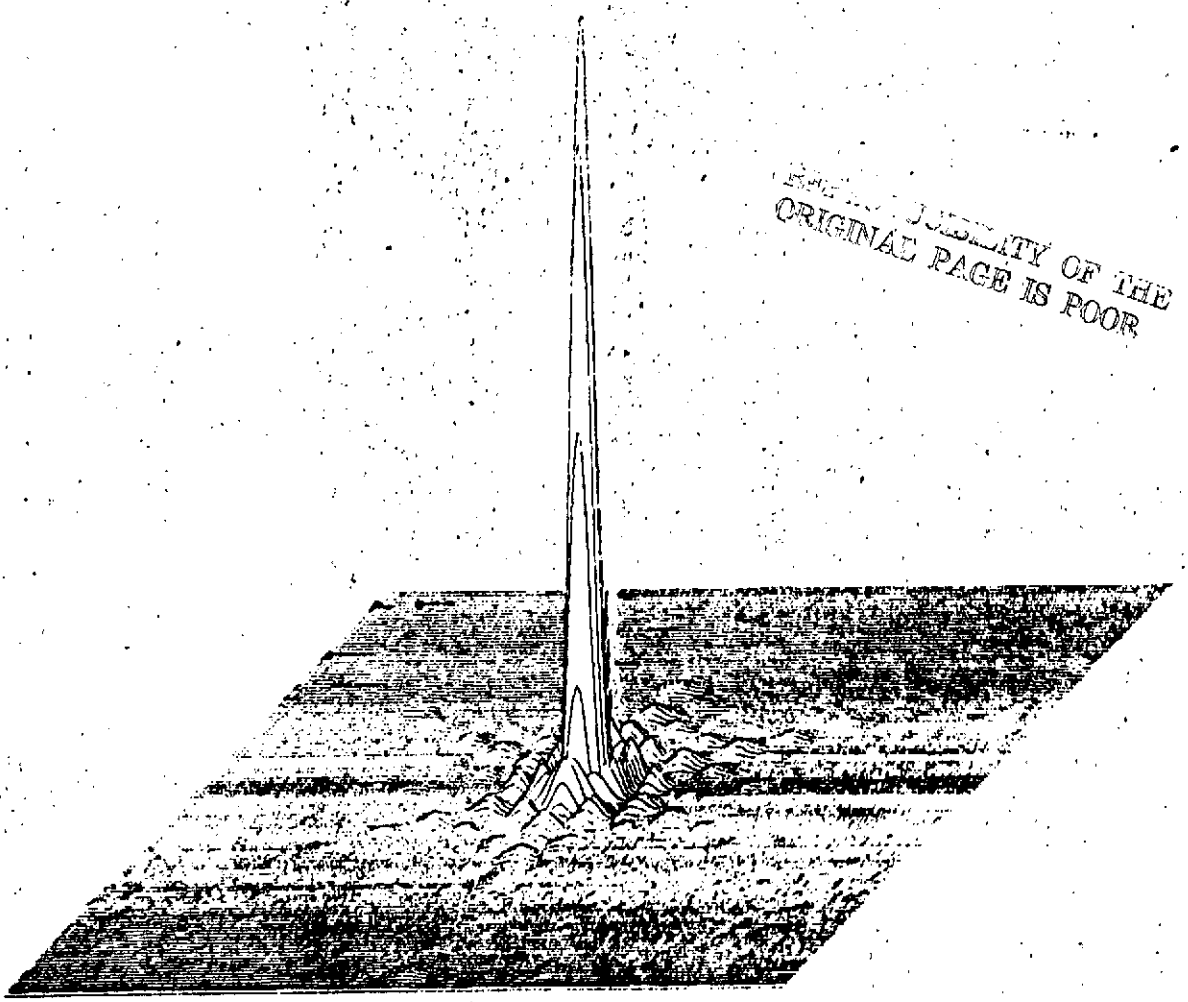

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Fig. A-1 — Intensity contours including beveled edge effects

easily calculated using Keller's "geometrical theory of diffraction," and the nature and spacing of the bright and dark rings is due to simple interference bewteen two critical points of the second kind on the rim of the diffracting aperture. The same theory also allows one to quickly and (without any paper work or detailed mathematics) correctly predict the qualitative effects of the spoked obstructions on the diffraction pattern as well as the relative orientation of the light fans in the pattern to the obstructions in the aperture.

APPENDIX B

Dihedral Angle Variation

If each of the dihedral angles of the corner were increased to a 2.1 sec from the nominal design of 1.5 sec the divergence of the energy would increase and the encircled energy in the 32-42 microradian ring would decrease. Table B1 provides a reference for locating figures and tables that apply to different cases. Table B 30 lists the encircled energy in the 32 to 42 microradian ring for the specified cases.

Figure Numbers and Tables that Give the Performance of the Specified Cases

Task	Case	Wavefront Maps	Wavefront Plots	Intensity Map	Intensity Plot	Encircled Energy Plot	Encircled Energy Tables
2.1	Nominal Cube-On Axis	B1, B3	B2, B4	B5	B6	B7	B2, B3
2.1	Nominal Cube- ¯15° Off Axis	B8, B10	B9, B11	B12	B13	B14	B4, B5
2.2	Nominal Cube - On Axis + 0.278λ mfg error	B15, B17	B16, B18	B19	B20	B21	B6, B7
2.2	Nominal Cube ¯15° Off Axis + 0.278λ mfg error	B22, B24	B23, B25	B26	B27	B28	B8, B9
2.3B	Nominal Cube On Axis + 0.278λ mfg error + first temperature case	B19, B31	B30, B32	B33	B34	B35	B10, B11
2.3B	Nominal Cube ¯15° Off Axis + 0.278λ mfg error + first temperature case	B36, B38	B37, B39	B40	B41	B42	B12, B13
2.3A1	Nominal Cube On Axis + 0.278λ mfg error + second temperature case	B43, B45	B44, B46	B47	B48	B49	B14, B15
2.3A2	Nominal Cube On Axis + 0.278λ mfg error + third temperature case	B50, B52	B51, B53	B54	B55	B56	B16, B17
2.5A	Nominal Cube On Axis + 0.278λ mfg error + axial gradient	B57, B59	B58, B60	B61	B62	B63	B18, B19
2.5B	Nominal Cube On Axis + 0.278λ mfg error + radial gradient	B64, B66	B65, B67	B68	B69	B70	B20, B21
2.4A	Off Nominal Cube On Axis + 0.278λ mfg error	B71, B73	B72, B74	B75	B76	B77	B22, B23
2.4A	Off Nominal Cube ¯15° Off Axis + 0.278λ mfg error	B78, B80	B79, B81	B82	B83	B84	B24, B25
2.4B2	Off Nominal Cube On Axis + 0.278λ mfg error, + 1st ΔT case	B85, B87	B86, B88	B89	B90	B91	B26, B27
2.4B2	Off Nominal Cube ¯15° Off Axis + 0.278λ mfg error + first temperature case	B92, B94	B93, B95	B96	B97	B98	B28, B29

TABLE B2

ENCIRCLED ENERGY

Task 2.1 - Nominal Cube-On Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
4.00	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.2	0.2
6.00	0.1	0.1	0.1	0.1	0.3	0.1	0.2	0.2	0.2
8.00	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.5
10.00	0.4	0.4	0.4	0.4	0.5	0.4	0.5	0.6	0.6
12.00	1.0	1.0	0.7	0.7	0.6	0.7	0.9	1.3	1.3
14.00	1.0	1.0	1.0	1.2	0.8	1.2	1.4	1.3	1.3
16.00	1.8	1.8	1.3	1.5	1.1	1.5	1.7	2.0	2.0
18.00	2.2	2.2	1.8	2.0	2.0	2.0	2.3	2.4	2.4
20.00	3.0	3.0	2.5	2.5	2.0	2.5	2.9	3.2	3.2
22.00	3.4	3.4	3.4	3.2	3.2	3.2	3.7	3.7	3.7
24.00	4.6	4.6	4.2	3.7	3.9	3.7	4.4	5.0	5.0
26.00	5.3	5.3	5.4	4.7	5.0	4.7	5.5	5.8	5.8
28.00	7.2	7.2	7.3	6.1	5.4	6.1	7.5	7.8	7.8
30.00	8.5	8.5	8.5	7.5	7.0	7.5	8.8	9.2	9.2
32.00	11.4	11.4	10.4	8.9	8.1	8.9	10.9	12.1	12.1
34.00	12.0	12.0	12.3	11.3	9.9	11.3	13.1	12.8	12.8
36.00	15.2	15.2	14.5	13.2	12.4	13.2	15.7	16.1	16.0
38.00	16.9	16.9	16.6	15.8	16.1	15.8	18.0	18.0	18.0
40.00	20.0	20.0	19.3	18.2	18.1	18.2	20.9	21.2	21.2
42.00	21.5	21.5	22.6	22.1	23.0	22.1	24.1	22.9	22.9
44.00	25.2	25.2	25.0	24.1	25.8	24.1	26.7	26.8	26.7
46.00	28.0	28.0	28.7	29.0	30.9	29.0	30.3	29.8	29.7
48.00	31.8	31.8	33.0	32.9	32.4	32.9	34.6	33.5	33.5
50.00	35.2	35.2	35.8	36.5	37.5	36.5	37.4	37.1	37.0
52.00	39.5	39.5	39.8	40.5	40.5	40.5	41.4	41.2	41.2
54.00	41.9	41.9	43.2	44.7	45.2	44.7	45.0	43.6	43.6
56.00	46.4	46.4	47.9	49.0	48.8	49.0	49.6	47.9	47.9
58.00	49.8	49.8	50.8	52.0	54.0	52.0	52.6	51.3	51.3
60.00	53.3	53.3	54.7	56.1	57.9	56.0	56.5	54.7	54.7
62.00	55.9	55.9	58.3	59.9	62.2	59.9	59.8	57.2	57.2
64.00	60.2	60.2	61.0	62.7	65.6	62.7	62.6	61.3	61.3
66.00	62.8	62.7	64.8	66.6	69.3	66.6	66.0	63.9	63.9
68.00	66.2	66.2	67.7	69.2	71.1	69.2	68.6	67.2	67.2
70.00	68.4	68.4	70.7	71.9	73.9	71.9	71.2	69.2	69.2
72.00	71.6	71.6	72.9	74.1	76.1	74.1	73.3	72.2	72.2
74.00	73.2	73.2	75.6	76.3	78.0	76.3	75.6	73.6	73.7
76.00	75.8	75.8	77.6	78.0	79.3	78.0	77.5	76.1	76.1
78.00	77.5	77.5	78.9	79.2	80.7	79.2	78.9	77.6	77.6
80.00	79.1	79.1	80.4	80.6	81.7	80.6	80.4	79.2	79.2

TABLE B3

ENCIRCLED ENERGY

Task 2.1 - Nominal Cube-On Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.2	0.2
10.00	0.4	0.4	0.4	0.4	0.5	0.4	0.5	0.6	0.6
15.00	1.5	1.5	1.2	1.3	1.1	1.3	1.6	1.7	1.7
20.00	3.0	3.0	2.5	2.5	2.0	2.5	2.9	3.2	3.2
25.00	5.1	5.1	5.1	4.5	4.3	4.5	5.2	5.5	5.5
30.00	8.5	8.5	8.5	7.5	7.0	7.5	8.8	9.2	9.2
35.00	13.9	13.9	13.2	11.8	11.7	11.8	14.1	14.6	14.6
40.00	20.0	20.0	19.3	18.2	18.1	18.2	20.9	21.2	21.2
45.00	26.7	26.7	27.0	27.3	28.6	27.3	28.6	28.3	28.3
50.00	35.2	35.2	35.8	36.5	37.5	36.5	37.4	37.1	37.0
55.00	44.9	44.8	45.7	46.8	47.9	46.8	47.4	46.4	46.4
60.00	53.3	53.3	54.7	56.1	57.9	56.0	56.5	54.7	54.7
65.00	61.3	61.3	63.4	65.1	67.8	65.1	64.7	62.5	62.5
70.00	68.4	68.4	70.7	71.9	73.9	71.9	71.2	69.2	69.2
75.00	74.8	74.8	76.6	77.2	78.7	77.2	76.6	75.1	75.1
80.00	79.1	79.1	80.4	80.6	81.7	80.6	80.4	79.2	79.2
85.00	82.0	82.0	83.1	83.0	83.9	83.0	83.2	82.1	82.1
90.00	84.2	84.2	84.8	84.7	85.2	84.7	85.0	84.3	84.3
95.00	85.9	85.9	86.1	86.1	86.2	86.1	86.2	86.0	86.0
100.00	87.0	87.0	87.1	87.2	87.3	87.2	87.1	87.1	87.1
105.00	87.9	87.9	88.0	88.2	88.3	88.2	88.1	88.0	88.0
110.00	88.8	88.8	88.9	89.1	89.2	89.1	89.0	88.9	88.9
115.00	89.6	89.6	89.7	89.7	90.0	89.7	89.8	89.7	89.7
120.00	90.3	90.3	90.5	90.4	90.6	90.4	90.5	90.4	90.4
125.00	90.9	90.9	91.1	91.0	91.1	91.0	91.1	90.9	90.9
130.00	91.4	91.4	91.5	91.5	91.6	91.5	91.6	91.5	91.5
135.00	92.0	92.0	91.9	92.0	92.0	92.0	91.9	91.9	91.9
140.00	92.4	92.4	92.4	92.5	92.4	92.5	92.4	92.4	92.4
145.00	92.8	92.8	92.8	92.9	92.8	92.9	92.9	92.8	92.8
150.00	93.2	93.2	93.2	93.2	93.3	93.2	93.3	93.2	93.2
155.00	93.5	93.5	93.6	93.5	93.7	93.5	93.6	93.5	93.5
160.00	93.9	93.9	93.9	93.9	93.9	93.9	93.9	93.9	93.9
165.00	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2
170.00	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.5
175.00	94.8	94.8	94.8	94.8	94.7	94.8	94.8	94.8	94.8
180.00	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1
184.99	95.4	95.4	95.3	95.4	95.4	95.4	95.4	95.4	95.4
189.99	95.6	95.6	95.6	95.7	95.7	95.7	95.7	95.6	95.6
194.99	95.9	95.9	95.9	95.9	95.9	95.9	95.9	95.9	95.9
199.99	96.1	96.1	96.1	96.1	96.1	96.1	96.1	96.2	96.2

FIGURE B1

Wavefront Map-0 Polarization
Task 2.1 - Nominal Cube-On Axis

MAP IN UNITS OF 0.01 WAVES

```
                                                  56  92  87  82  77  77  82  87  92  96
                                          102  98  93  88  83  79  74  69  69  74  79  83  88  93  98 102
                                      99  94  89  85  80  75  70  66  61  61  66  70  75  80  85  89  94  99
                                  95  91  86  81  76  72  67  62  57  53  53  57  62  67  72  76  81  86  91  95
                              92  87  82  78  73  68  63  59  54  49  44  44  49  54  59  63  68  73  78  82  87  92
                          88  84  79  74  69  65  60  55  50  46  41  36  36  41  46  50  55  60  65  69  74  79  84  88
                      85  80  75  71  66  61  56  52  47  42  37  33  28  28  33  37  42  47  52  56  61  66  71  75  80  85
                157  77  72  67  62  58  53  48  43  39  34  29  24  20  20  24  29  34  39  43  48  53  58  62  67  72  77 157
                157 148 138  59  54  49  45  40  35  30  26  21  16  11  11  16  21  26  30  35  40  45  49  54  59 138 148 157
                157 148 138 129  46  41  36  32  27  22  17  13   8   3   3   8  13  17  22  27  32  36  41  46 129 138 148 157
            167 157 148 138 129 119 110  28  23  19  14   9   4   0  -4  -4   0   4   9  14  19  23  28 110 119 129 138 148 157 167
            167 157 148 138 129 119 110 100  91  10   6   1  -3  -8 -12 -12  -8  -3   1   6  10  91 100 110 119 129 138 148 157 167
            167 157 148 138 129 119 110 100  91  81  72  -6 -11 -16 -21 -21 -16 -11  -6  72  81  91 100 110 119 129 138 148 157 167
            167 157 148 138 129 119 110 100  91  81  72  62 -19 -24 -29 -29 -24 -19  62  72  81  91 100 110 119 129 138 148 157 167
            167 157 148 138 129 119 110 100  91  81  72  62  53  43 -37 -37  43  53  62  72  81  91 100 110 119 129 138 148 157 167
            167 157 148 138 129 119 110 100  91  81  72  62  53  43 -37 -37  43  53  62  72  81  91 100 110 119 129 138 148 157 167
            167 157 148 138 129 119 110 100  91  81  72  62 -19 -24 -29 -29 -24 -19  62  72  81  91 100 110 119 129 138 148 157 167
            167 157 148 138 129 119 110 100  91  81  72  -6 -11 -16 -21 -21 -16 -11  -6  72  81  91 100 110 119 129 138 148 157 167
            167 157 148 138 129 119 110 100  91  10   6   1  -3  -8 -12 -12  -8  -3   1   6  10  91 100 110 119 129 138 148 157 167
            167 157 148 138 129 119 110  28  23  19  14   9   4   0  -4  -4   0   4   9  14  19  23  28 110 119 129 138 148 157 167
                157 148 138 129  46  41  36  32  27  22  17  13   8   3   3   8  13  17  22  27  32  36  41  46 129 138 148 157
                157 148 138  59  54  49  45  40  35  30  26  21  16  11  11  16  21  26  30  35  40  45  49  54  59 138 148 157
                157  77  72  67  62  58  53  48  43  39  34  29  24  20  20  24  29  34  39  43  48  53  58  62  67  72  77 157
                    85  80  75  71  66  61  56  52  47  42  37  33  28  28  33  37  42  47  52  56  61  66  71  75  80  85
                        88  84  79  74  69  65  60  55  50  46  41  36  36  41  46  50  55  60  65  69  74  79  84  88
                            92  87  82  78  73  68  63  59  54  49  44  44  49  54  59  63  68  73  78  82  87  92
                                95  91  86  81  76  72  67  62  57  53  53  57  62  67  72  76  81  86  91  95
                                    99  94  89  85  80  75  70  66  61  61  66  70  75  80  85  89  94  99
                                        102  98  93  88  83  79  74  69  69  74  79  83  88  93  98 102
                                                  56  92  87  82  77  77  82  87  92  96
```

FIGURE B2

Wavefront Plot-Q Polarization

Task 2.1 - Nominal Cube-On Axis

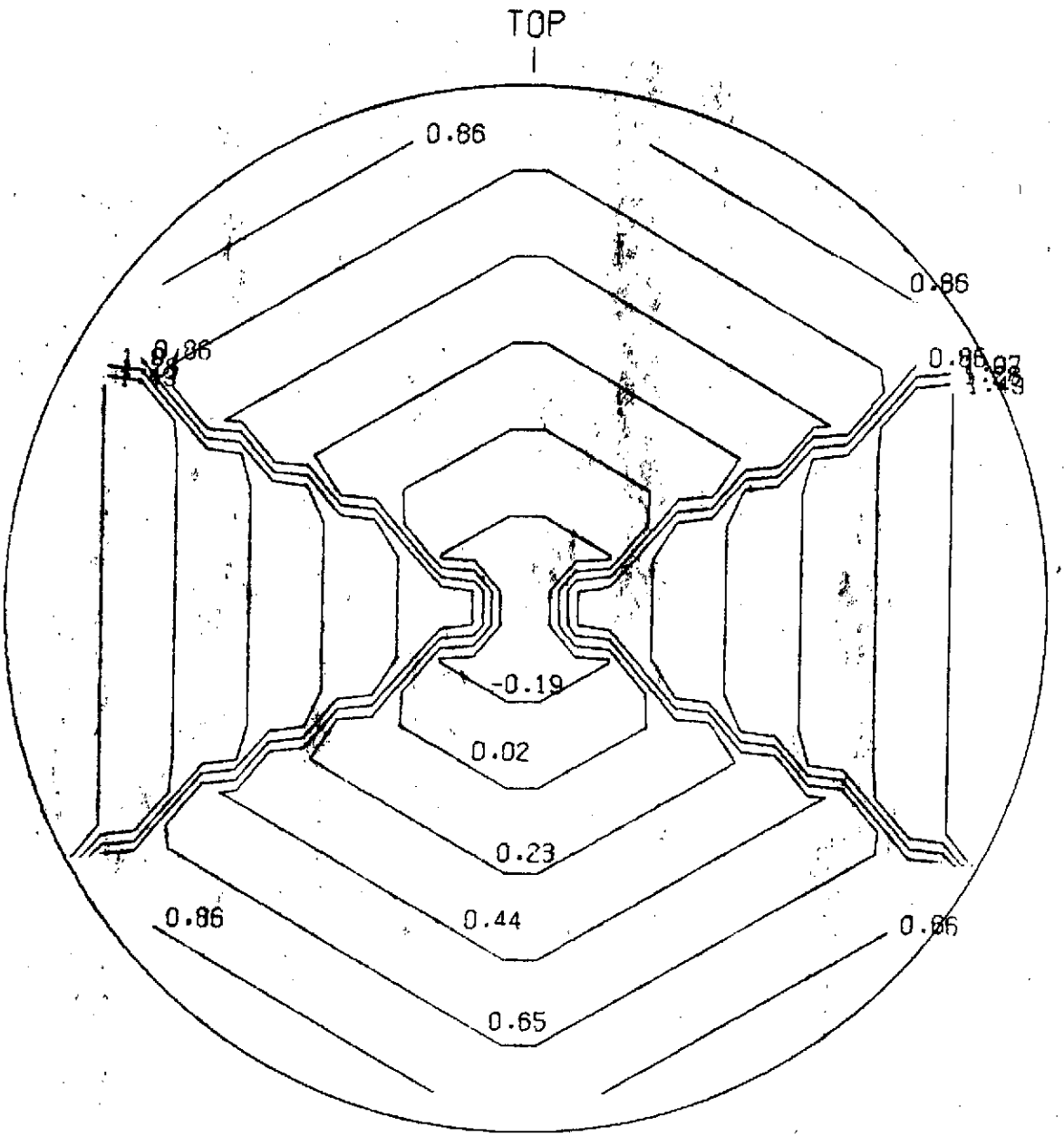


FIGURE B3

Wavefront Map-P Polarisation

Task 2.1 - Nominal Cube-On Axis

MAP IN UNITS OF 0.01 WAVES

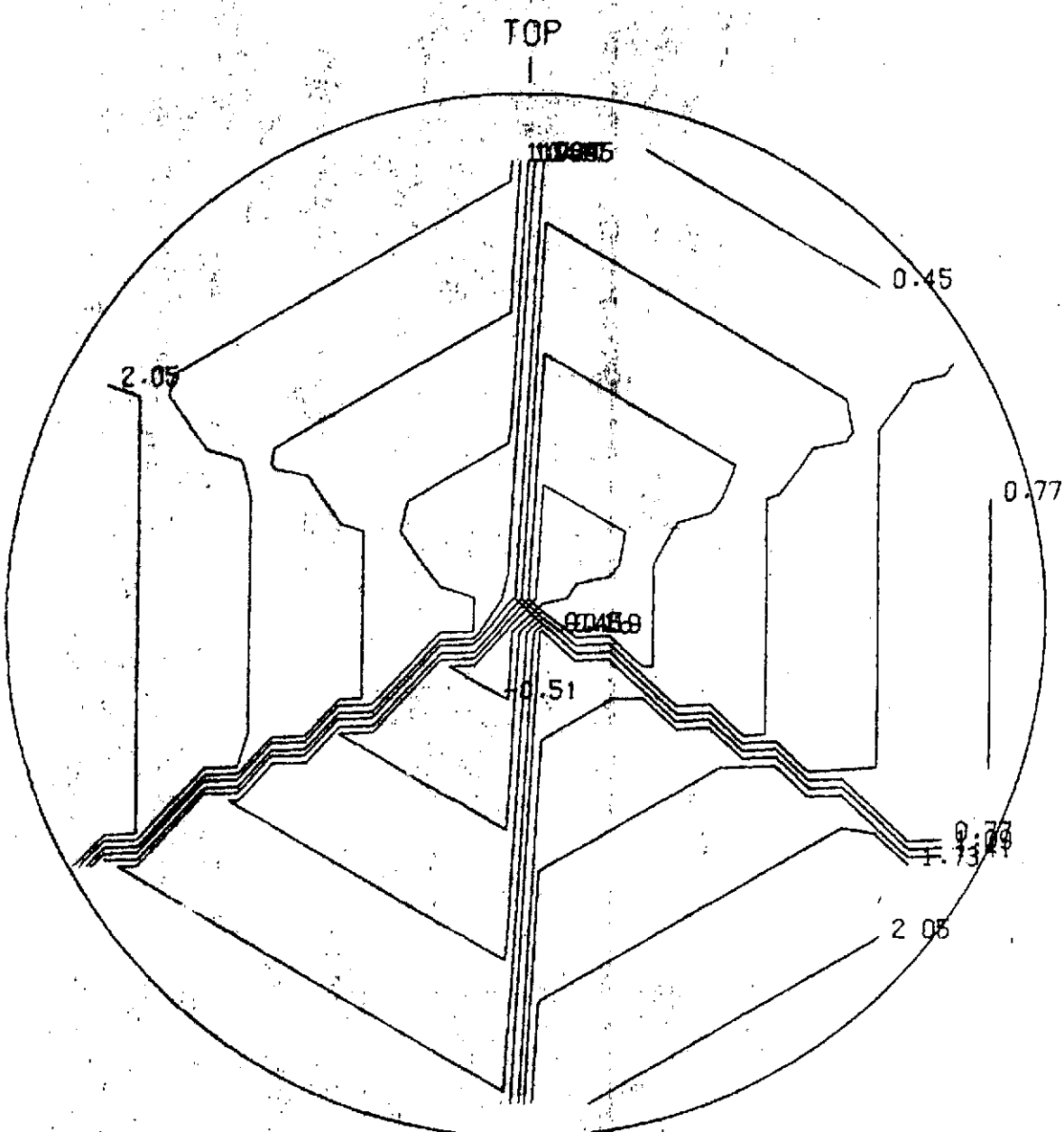

```
                                                205 200 195 190 186  36  40  45  50  55
                                            211 206 201 197 192 187 182 177  27  32  37  42  47  51  56  61
                                        207 203 198 193 188 184 179 174 169  19  24  29  34  38  43  48  53  57
                                    204 199 194 190 185 180 175 171 166 161 -11  16  21  25  30  35  40  44  49  54
                                200 196 191 186 181 177 172 167 162 158 153   3   8  12  17  22  27  31  36  41  46  53
                            197 192 187 183 178 173 168 164 159 154 149 145  -4   0   4   9  14  18  23  28  33  37  42  47
                        193 189 184 179 176 170 165 160 155 151 146 141 136 -13  -8  -3   1   5  10  15  20  24  29  34  39  43
                223 185 180 176 171 166 161 157 152 147 142 138 133 128 -21 -16 -11  -7  -2   2   7  11  16  21  26  30  35  73
                223 214 204 167 163 158 153 148 144 139 134 129 125 120 -29 -24 -20 -15 -10  -5  -1   3   8  13  17  54  64  73
                223 214 204 195 154 153 145 140 135 131 126 121 116 112 -37 -33 -28 -23 -18 -14  -9  -4   0   4  45  54  64  73
            233 223 214 204 195 185 176 137 132 127 122 118 113 108 103 -46 -41 -36 -31 -27 -22 -17 -12  26  35  45  54  64  73  83
            233 223 214 204 195 185 176 166 157 119 114 109 105 100  95 -54 -49 -44 -40 -35 -30   7  16  26  35  45  54  64  73  83
            233 223 214 204 195 185 176 166 157 147 137 101  96  92  87 -62 -57 -53 -48 -12  -2   7  16  26  35  45  54  64  73  83
            233 223 214 204 195 185 176 166 157 147 137 128  88  83  79 -70 -66 -61 -21 -12  -2   7  16  26  35  45  54  64  73  83
            233 223 214 204 195 185 176 166 157 147 137 128 118 109  70 -79 -40 -31 -21 -12  -2   7  16  26  35  45  54  64  73  83
            233 223 214 204 195 185 176 166 157 147 137 128 118 109 -67  82 -40 -31 -21 -12  -2   7  16  26  35  45  54  64  73  83
            233 223 214 204 195 185 176 166 157 147 137 128 -49 -54 -59  90  95 100 -21 -12  -2   7  16  26  35  45  54  64  73  83
            233 223 214 204 195 185 176 166 157 147 137 -36 -41 -46 -51  99 103 108 113 -12  -2   7  16  26  35  45  54  64  73  83
            233 223 214 204 195 185 176 166 157 -19 -23 -28 -33 -38 -42 107 112 116 121 126 131  -7  16  26  35  45  54  64  73  83
            233 223 214 204 195 185 176  -1  -6 -10 -15 -20 -25 -29 -34 115 120 125 129 134 139 144 148  26  35  45  54  64  73  83
            223 214 204 195  16  11   6   2  -2  -7 -12 -16 -21 -26 123 128 133 138 142 147 152 157 161 166  45  54  64  73
            223 214 204  29  24  19  15  10  -5   0  -3  -8 -13 -18 132 136 141 146 151 155 160 165 170 174 179  54  64  73
            223  47  42  37  32  28  23  18  13   9   4   0  -5  -9 140 145 149 154 159 164 168 173 178 183 187 192 197  73
                55  50  45  41  36  31  26  22  17  12   7   3  -1 148 153 158 162 167 172 177 181 186 191 196 200 205
                58  54  49  44  39  35  30  25  20  16  11   6 156 161 166 171 175 183 185 193 194 199 204 209
                    62  57  52  48  43  38  33  29  24  19  14 165 169 174 179 184 188 193 198 203 207 212
                        65  61  56  51  46  42  37  32  27  23 173 178 182 187 192 197 201 206 211 216
                            69  64  59  55  50  45  40  36  31 181 186 191 195 200 205 210 214 219
                                72  68  63  58  53  49  44  39 189 194 199 204 208 213 218 223
                                    66  62  57  52  47 197 202 207 212 217
```

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

ADD P POLAR AVERAGE AV_RAG_
1
NONE S 0.8 -PK 3.1 F ED AV_F ONT

FIGURE B4

Wavefront Plot-P Polarization
Task 2.1 - Nominal Cube-On Axis



REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

FIGURE 35 : B5

Task 2.1 - Nominal Cube-On Axis

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0176 = 100
TOTAL ENERGY = 0.2461000D+01
MAP REPRESENTS 0.2308797D+01 OR 93.8154 PERCENT OF TOTAL ENERGY

```
 1  1  1  1  0  0  0  1  1  0  1  1  1  1  2  1  0  0  0  1  2  1  1  1  1  0  1  1  0  0  0  1  1  1  1
 1  1  1  1  0  0  0  1  1  1  1  1  1  2  3  3  1  0  1  3  3  2  1  1  1  1  1  1  0  0  0  1  1  1  1
 1  1  1  0  0  0  1  1  0  0  1  0  1  1  2  2  1  1  1  2  2  1  1  0  1  0  0  1  1  0  0  0  1  1  1
 0  0  1  1  0  1  1  0  0  1  1  0  1  1  1  1  2  2  2  1  1  1  0  1  1  0  0  1  1  0  0  0  1  1  1
 0  0  1  1  1  1  1  1  1  1  1  1  1  1  2  3  4  5  4  3  2  1  1  1  1  1  1  1  1  1  1  1  1  0  0
 0  0  0  2  2  1  1  1  0  2  3  2  2  1  1  4  9 13  9  4  1  1  2  2  3  2  0  1  1  1  2  2  0  0  0
 0  0  1  2  1  1  1  0  1  3  2  2  3  1  1  2  7 11  7  2  1  1  3  2  2  3  1  0  1  1  1  2  1  0  0
 0  0  1  1  1  1  1  1  1  1  2  5  3  2  5  4  4  6  4  4  5  2  3  5  2  1  1  1  1  1  1  1  1  0  0
 0  1  1  0  0  1  1  2  2  1  3  4  7 14 17 14 11 10 11 14 17 14  7  4  3  1  2  2  1  1  0  0  1  1  0
 1  1  0  0  0  2  3  2  2  2  3 11 24 32 35 35 32 29 32 35 35 32 24 11  3  2  2  2  3  2  0  0  0  1  1
 1  1  0  1  2  3  4  2  2  2  9 21 31 45 65 65 49 42 49 65 65 45 31 21  9  2  2  2  4  3  2  1  0  1  1
 2  1  2  2  3  5  6  6  4  5 13 26 46 75 91 75 62 65 62 75 91 75 46 26 13  5  4  6  6  5  3  2  2  1  2
 1  2  2  1  2  5  7  8  7  7 15 34 58 80 82 74 79 86 79 74 82 80 58 34 15  7  7  8  7  5  2  1  2  2  1
 1  1  1  1  2  3  4  6 10 12 24 35 42 61 74 69 51 37 51 69 74 61 42 34 24 12 10  6  4  3  2  1  1  1  1
 1  1  0  2  2  2  1  6 14 21 32 31 33 48 56 44 27 22 27 43 56 48 33 31 32 21 14  6  1  2  2  2  0  1  1
 0  1  1  2  2  1  1  8 18 27 33 28 31 23 28 27 15 21 15 27 28 23 31 28 33 27 18  8  1  1  2  2  1  1  0
 0  1  3  4  1  2  3 12 20 31 35 30 40 19 27 27  3 11  3 27 27 19 40 30 35 31 20 12  3  2  1  4  3  1  0
 1  1  2  4  2  2  4 13 19 33 39 31 47 23 14 15 10 30 10 15 14 23 47 31 39 33 19 13  4  2  2  4  2  1  1
 1  1  1  4  2  2  2 11 19 31 41 23 28 14 11 26 13 11 13 26 11 14 28 24 41 31 19 11  2  2  2  4  1  1  1
 0  0  1  3  1  1  1 10 17 20 26 12 16 25 28 39 30 21 30 39 28 25 16 12 26 20 17 10  1  1  1  3  1  0  0
 0  1  1  2  1  1  2  7 10  6 15 22 37 67 66 40 24 22 24 43 66 66 37 22 15  6 10  7  2  1  1  2  1  1  0
 1  1  1  2  2  3  2  2  4  5 24 50 65 87100 81 51 37 51 81100 87 65 49 24  5  4  2  2  3  2  2  1  1  1  0
 1  0  1  1  2  2  1  3  6 10 25 52 76 86 90 91 89 86 88 91 89 85 75 52 25 10  6  2  1  2  2  1  1  0  1
 1  1  2  2  1  1  3  8 11 11 15 31 62 92 96 79 67 65 66 78 95 92 62 31 15 11 11  8  3  1  1  2  2  1  1
 1  1  1  1  1  3  5  7  7  4  7 18 37 64 83 73 51 42 50 72 83 64 37 18  7  4  7  7  5  3  1  1  1  1  1
 1  0  0  0  1  3  5  3  3  1  2 12 23 29 34 35 31 29 31 35 34 29 23 12  2  1  3  3  5  3  1  0  0  0  1
 0  0  1  1  0  2  3  2  2  3  3  4 10 14 13 12 11 10 11 11 13 14 10  4  3  3  2  2  3  2  0  1  1  0  0
 0  0  1  1  1  1  1  1  2  4  4  2  2  5  7  6  6  6  7  5  2  2  4  4  2  1  1  1  1  1  1  1  0  0  0
 0  0  1  2  2  2  2  0  1  2  3  4  3  1  1  3  8 11  8  3  1  1  3  4  3  2  1  0  2  2  2  2  1  0  0
 0  0  1  2  3  2  2  1  0  2  2  2  2  1  1  3  9 13  9  3  1  1  2  2  2  2  0  1  2  2  3  2  1  0  0
 0  0  0  1  2  1  1  1  1  1  1  1  1  1  2  3  4  5  4  3  2  1  1  1  1  1  1  1  1  1  2  1  0  0  0
 1  1  0  0  0  0  0  0  1  1  1  0  1  1  2  2  2  3  2  3  2  2  2  1  0  1  1  1  0  0  0  0  0  1  1
 1  2  1  1  0  0  0  1  1  1  1  1  1  2  2  2  2  1  1  1  2  2  2  1  1  1  1  1  0  0  0  0  0  1  1
 1  2  2  1  1  0  0  1  1  1  1  1  0  1  2  3  3  1  0  1  3  3  2  1  0  1  1  1  1  0  0  0  1  1  2
 0  1  1  1  0  0  0  0  0  0  0  1  1  1  2  1  0  0  0  1  2  1  1  1  0  0  0  0  0  0  0  1  1  2  1
10
10
```

FIGURE B6

Intensity Distriubtion - Central 129 Microradians

Task 2.1 - Nominal Cube-On Axis

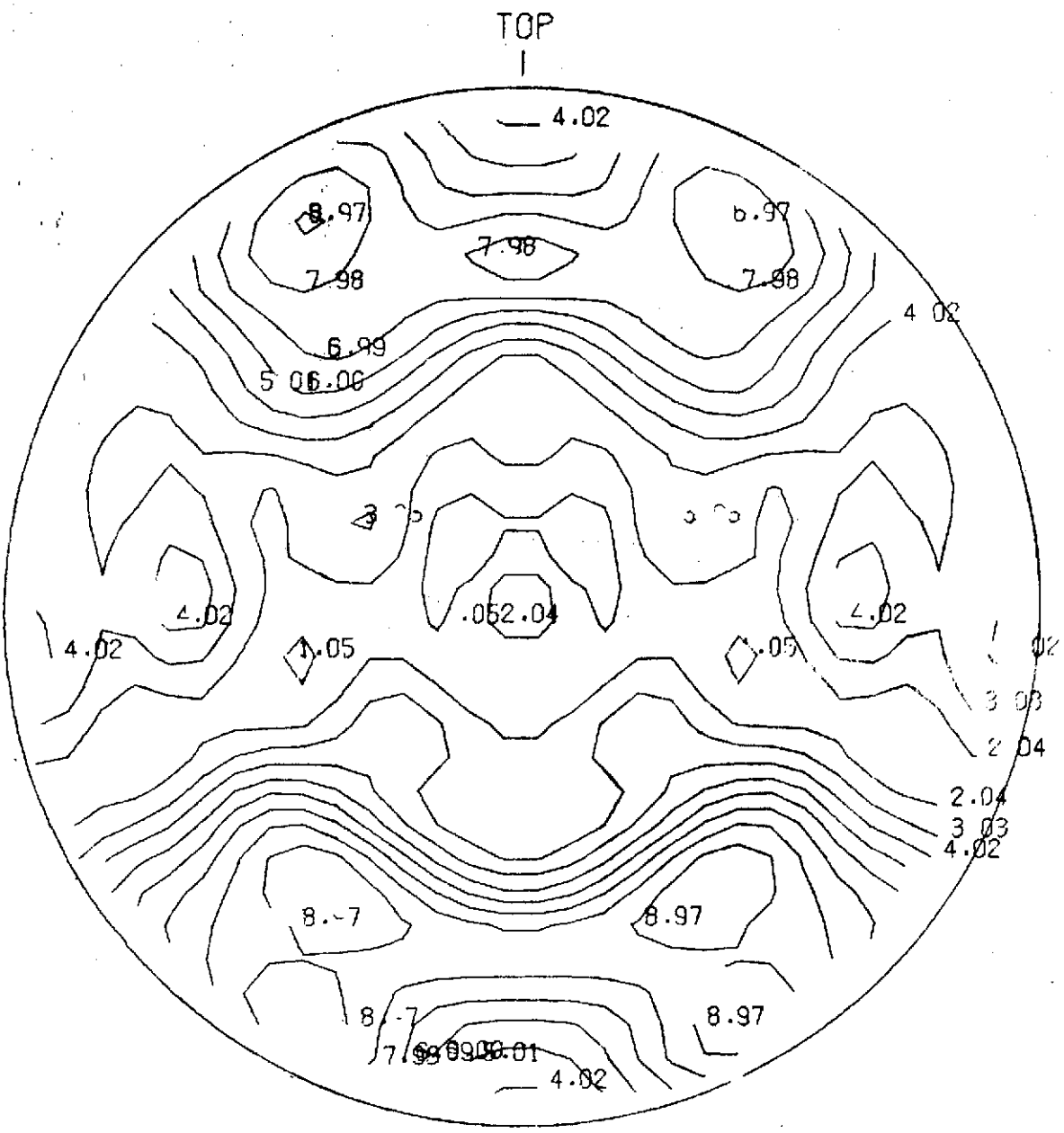


FIGURE B7

Encircled Energy
Vs
Field Angle
Task 2.1 - Nominal Cube-On Axis

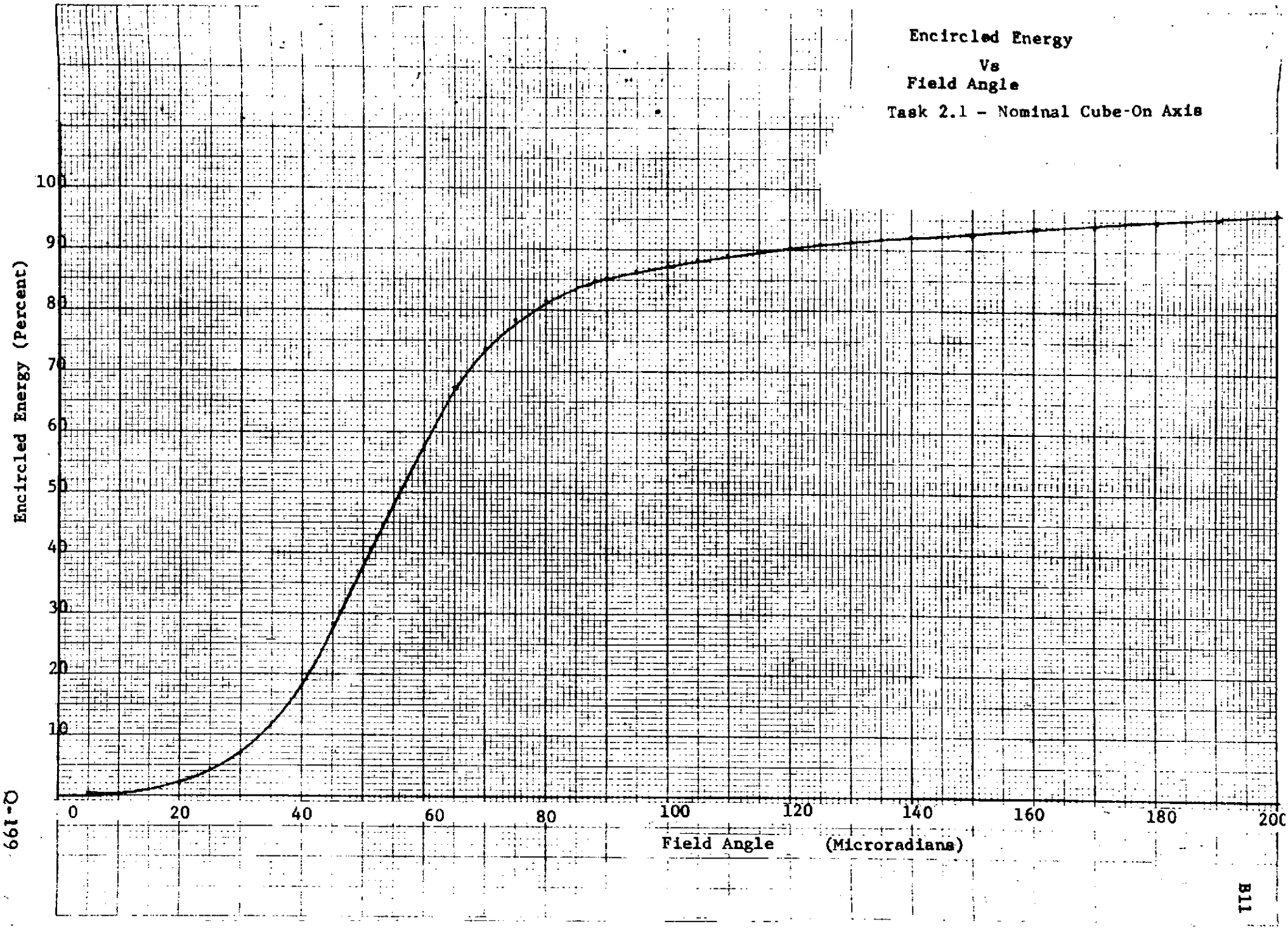


TABLE B4

ENCIRCLED ENERGY

Task 2.1 - Nominal Cube -15° Off Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
4.00	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.2	0.2
6.00	0.1	0.1	0.1	0.1	0.4	0.1	0.2	0.2	0.2
8.00	0.4	0.4	0.3	0.3	0.4	0.3	0.3	0.6	0.6
10.00	0.6	0.6	0.4	0.5	0.7	0.5	0.5	0.8	0.8
12.00	1.4	1.4	0.7	0.9	0.8	0.9	0.9	1.7	1.7
14.00	1.4	1.4	1.1	1.5	1.0	1.5	1.5	1.7	1.7
16.00	2.5	2.5	1.6	2.1	1.2	2.0	2.0	2.9	2.9
18.00	2.9	2.9	2.3	2.8	2.1	2.8	2.8	3.4	3.4
20.00	3.9	3.9	3.1	3.6	2.1	3.6	3.9	4.5	4.5
22.00	4.4	4.4	4.3	4.6	3.8	4.6	5.2	5.1	5.1
24.00	5.7	5.7	5.0	5.2	5.0	5.2	5.9	6.5	6.5
26.00	6.3	6.3	6.6	6.6	7.2	6.6	7.5	7.4	7.4
28.00	8.1	8.1	8.3	8.2	8.0	8.2	9.4	9.2	9.2
30.00	9.5	9.5	9.8	9.7	10.4	9.7	10.8	10.8	10.8
32.00	12.3	12.3	11.3	11.3	11.9	11.3	12.4	13.4	13.4
34.00	12.9	12.9	13.4	13.7	13.6	13.7	14.6	14.1	14.1
36.00	16.2	16.2	15.5	15.9	16.0	15.9	16.7	17.2	17.2
38.00	18.0	18.0	17.7	18.2	18.4	18.2	18.8	19.2	19.2
40.00	21.0	21.0	20.3	20.8	20.0	20.8	21.6	22.1	22.1
42.00	22.6	22.6	23.5	23.9	23.1	23.9	24.8	23.8	23.8
44.00	25.9	25.9	25.4	25.6	25.8	25.6	27.0	27.3	27.3
46.00	28.5	28.4	29.0	29.3	29.9	29.3	30.8	30.3	30.3
48.00	31.3	31.3	32.3	32.5	31.5	32.5	34.7	33.3	33.3
50.00	34.3	34.3	34.9	35.2	36.2	35.2	37.2	36.7	36.7
52.00	37.5	37.5	37.8	38.3	39.6	38.3	40.6	40.2	40.2
54.00	39.5	39.5	41.0	41.9	43.4	41.9	43.9	42.3	42.3
56.00	43.2	43.2	44.7	45.8	47.0	45.8	47.9	46.0	46.0
58.00	46.3	46.3	47.3	48.5	50.9	48.5	50.2	49.2	49.2
60.00	49.5	49.5	51.0	52.3	54.1	52.3	53.8	52.1	52.1
62.00	52.0	52.0	54.2	55.8	57.2	55.8	56.8	54.5	54.5
64.00	56.2	56.2	56.8	58.3	60.2	58.3	59.3	58.2	58.2
66.00	58.9	58.9	60.5	61.9	63.4	61.9	62.5	60.8	60.8
68.00	61.9	62.0	63.4	64.3	64.9	64.3	65.0	63.5	63.5
70.00	64.5	64.5	66.1	67.0	67.9	67.0	67.5	65.9	65.9
72.00	67.3	67.3	68.4	69.0	70.8	69.0	69.4	68.5	68.4
74.00	68.9	68.9	71.1	71.5	73.0	71.5	72.0	70.0	70.0
76.00	71.5	71.5	73.3	73.5	75.1	73.5	73.9	72.4	72.4
78.00	73.5	73.5	74.6	75.1	77.1	75.1	75.3	74.2	74.2
80.00	75.1	75.1	76.6	77.0	78.7	77.0	77.1	75.7	75.7

TABLE B5

ENCIRCLED ENERGY

Task 2.1 - Nominal Cube -15° Off Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.2	0.2
10.00	0.6	0.6	0.4	0.5	0.7	0.5	0.5	0.8	0.8
15.00	2.1	2.1	1.4	1.8	1.2	1.8	1.8	2.4	2.4
20.00	3.9	3.9	3.1	3.6	2.1	3.6	3.9	4.5	4.5
25.00	6.1	6.1	6.3	6.4	5.6	6.4	7.3	7.1	7.1
30.00	9.5	9.5	9.8	9.7	10.4	9.7	10.8	10.8	10.8
35.00	14.9	14.9	14.2	14.4	15.3	14.4	15.2	15.9	15.9
40.00	21.0	21.0	20.3	20.8	20.0	20.8	21.6	22.1	22.1
45.00	27.1	27.1	27.6	28.0	27.6	28.0	29.3	28.7	28.7
50.00	34.3	34.3	34.9	35.2	36.2	35.2	37.2	36.7	36.7
55.00	41.9	41.9	42.7	43.6	46.2	43.6	45.6	44.7	44.7
60.00	49.5	49.5	51.0	52.3	54.1	52.3	53.8	52.1	52.1
65.00	57.3	57.3	59.1	60.5	61.7	60.5	61.4	59.3	59.3
70.00	64.5	64.5	66.1	67.0	67.9	67.0	67.5	65.9	65.9
75.00	70.6	70.6	71.9	72.4	74.2	72.4	72.8	71.5	71.4
80.00	75.1	75.1	76.6	77.0	78.7	77.0	77.1	75.7	75.7
85.00	78.7	78.7	80.1	80.7	81.8	80.7	80.5	79.2	79.2
90.00	81.7	81.7	82.5	82.9	83.6	82.9	82.6	81.9	81.9
95.00	83.9	83.9	84.3	84.4	84.7	84.4	84.2	83.9	83.9
100.00	85.4	85.4	85.5	85.5	85.5	85.5	85.4	85.2	85.2
105.00	86.3	86.3	86.3	86.4	86.4	86.4	86.3	86.2	86.2
110.00	87.2	87.2	87.2	87.3	87.3	87.3	87.2	87.2	87.2
115.00	88.0	88.0	88.1	88.1	88.2	88.1	88.2	88.1	88.1
120.00	88.8	88.8	89.0	88.9	89.1	88.9	89.1	88.9	88.9
125.00	89.5	89.5	89.7	89.7	89.9	89.7	89.8	89.6	89.6
130.00	90.2	90.2	90.3	90.4	90.6	90.4	90.4	90.2	90.2
135.00	90.8	90.8	90.8	91.0	91.0	91.0	90.9	90.9	90.9
140.00	91.3	91.3	91.4	91.5	91.4	91.5	91.5	91.5	91.5
145.00	91.8	91.8	91.7	91.9	91.8	91.9	92.0	91.9	91.9
150.00	92.2	92.2	92.2	92.3	92.3	92.3	92.3	92.3	92.3
155.00	92.6	92.6	92.7	92.7	92.7	92.7	92.6	92.7	92.7
160.00	93.1	93.1	93.1	93.0	93.1	93.0	93.0	93.0	93.0
165.00	93.5	93.5	93.6	93.5	93.4	93.5	93.4	93.4	93.4
170.00	93.9	93.9	93.9	93.9	93.9	93.9	93.8	93.8	93.8
175.00	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.1	94.1
180.00	94.5	94.5	94.5	94.5	94.6	94.5	94.5	94.5	94.5
184.99	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8
189.99	95.1	95.1	95.1	95.1	95.2	95.1	95.2	95.1	95.1
194.99	95.3	95.3	95.4	95.4	95.4	95.4	95.4	95.4	95.4
199.99	95.6	95.7	95.7	95.7	95.7	95.7	95.7	95.6	95.6

FIGURE B8

Wavefront Map-0 Polarization

Task 2.1 - Nominal Cube -15° Off Axis

MAP IN UNITS OF 0.01 WAVES

```
                                                197 192 192 197
                                        210 205 200 194 189 184 184 189 194 200 205 210
                                    213 207 202 197 192 186 181 176 176 181 186 192 197 202 207 213
                                210 205 199 194 189 184 178 173 168 168 173 178 184 189 194 199 205 210
                            212 207 202 196 191 186 181 175 170 165 160 160 165 170 175 181 186 191 196 202 207 212
                        209 204 199 194 188 183 178 173 167 162 157 151 151 157 162 167 173 178 183 188 194 199 204 209
                        201 196 191 186 180 175 170 164 159 154 149 143 143 149 154 159 164 170 175 180 186 191 196 201
                    190 181 172 183 177 172 167 162 156 151 146 141 135 135 141 146 151 156 162 167 172 177 183 172 181 190
                199 190 181 172 163 155 164 159 153 148 143 138 132 127 127 132 138 143 148 153 159 164 155 163 172 181 190 199
                199 190 181 172 163 155 146 137 128 140 135 130 124 119 119 124 130 135 140 128 137 146 155 163 172 181 190 199
            207 199 190 181 172 163 155 146 137 128 120 111 121 116 111 111 116 121 111 120 128 137 146 155 163 172 181 190 199 207
        207 199 190 181 172 163 155 146 137 128 120 111 102  93 103 103  93 102 111 120 128 137 146 155 163 172 181 190 199 207
        207 199 190 181 172 163 155 146 137 128 120 111 102 112 106 106 112 102 111 120 128 137 146 155 163 172 181 190 199 207
            199 190 181 172 163 155 146 137 128 120 130 125 120 115 115 120 125 130 120 128 137 146 155 163 172 181 190 199
            199 190 181 172 163 155 146 137 149 144 138 133 128 123 123 128 133 138 144 149 137 146 155 163 172 181 190 199
                190 181 172 163 173 168 162 157 152 147 141 136 131 131 136 141 147 152 157 162 168 173 163 172 181 190
                190 181 192 186 181 176 171 165 160 155 149 144 139 139 144 149 155 160 165 171 176 181 186 192 181 190
                    205 200 194 189 184 179 173 168 163 158 152 147 147 152 158 163 168 173 179 184 189 194 200 205
                        208 203 197 192 187 181 176 171 166 160 155 155 160 166 171 176 181 187 192 197 203 208
                            211 205 200 195 190 184 179 174 169 163 163 169 174 179 184 190 195 200 205 211
                                214 208 203 198 192 187 182 177 171 171 177 182 187 192 198 203 208 214
                                        211 206 201 195 190 185 179 179 185 190 195 201 206 211
                                            209 203 198 193 188 188 193 198 203 209
```

C-202

400		Q POLARI	AVERAGE	AVERAGE			
1							
NONE		RMS	0.28	PK-PK	1.20	FRED	WAVEFRONT

FIGURE B9

Wavefront Plot-Q Polarization

Task 2.1 - Nominal Cube -15° Off Axis

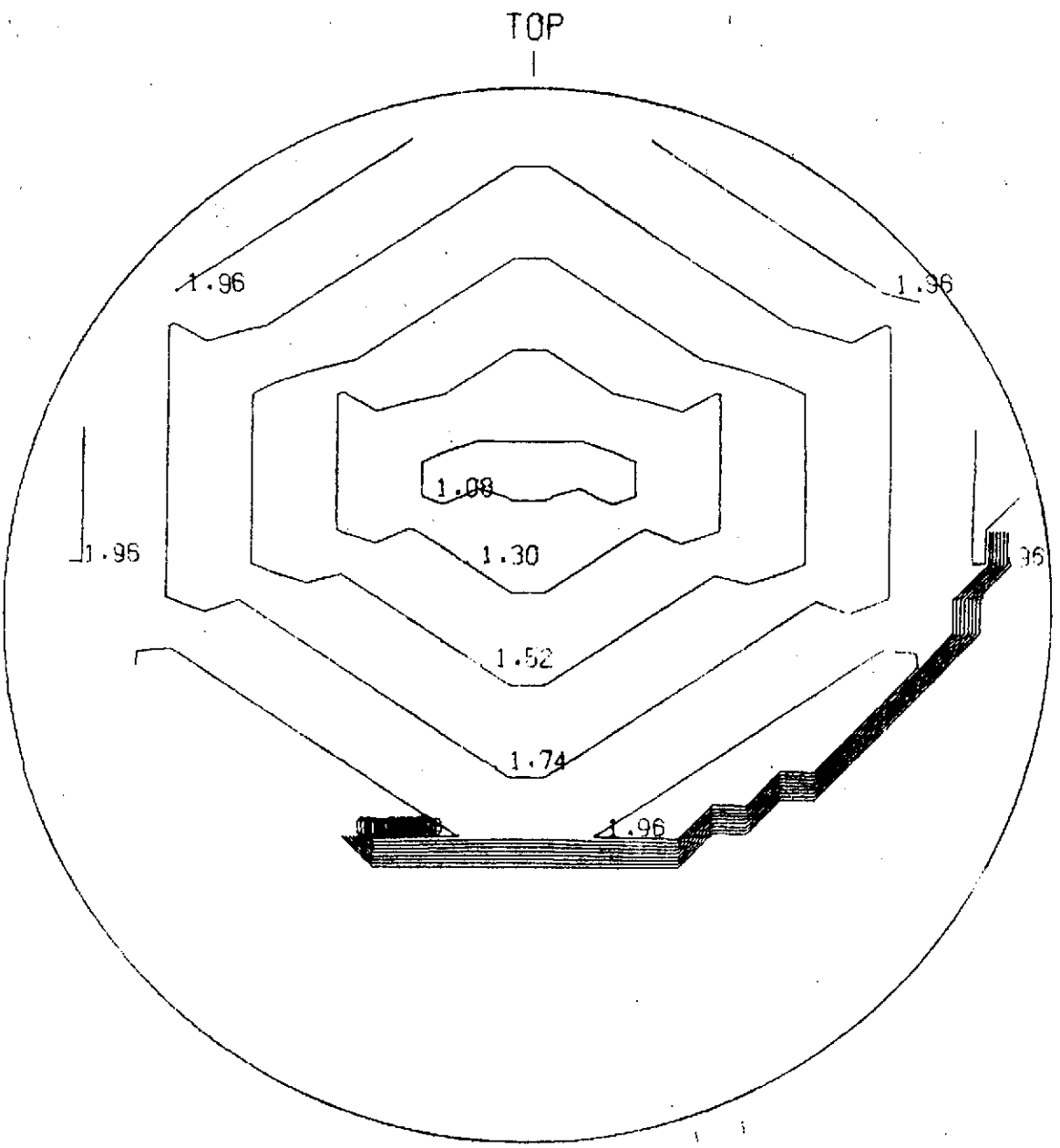


FIGURE B10

Wavefront Map-P Polarization

Task 2.1 - Nominal Cube -15° Off Axis

MAP IN UNITS OF 0.01 WAVES

```
                                                  167 161  11  17
                                  180 174 169 164 159 153   3   9  14  19  24  30
                              182 177 172 166 161 156 150 145  -4   0   6  11  16  22  27  32
                          179 174 169 163 158 153 148 142 137 -12  -7  -1   3   8  13  19  24  29
                      182 176 171 166 161 155 150 145 140 134 129 -20 -15  -9  -4   0   5  11  16  21  26  32
                  179 174 168 163 158 153 147 142 137 131 126 121 -28 -23 -18 -12  -7  -2   3   8  13  18  24  29
                  171 165 160 155 150 144 139 134 129 123 118 113 -36 -31 -26 -20 -15 -10  -5   0   5  10  15  21
              206 197 189 152 147 142 136 131 126 120 115 110 105 -44 -39 -34 -29 -23 -18 -13  -7  -2   2  39  48  57
          215 206 197 189 180 171 133 128 123 118 112 107 102  97 -52 -47 -42 -37 -31 -26 -21 -16  22  30  39  48  57  66
          215 206 197 189 180 171 162 153 145 110 104  99  94  88 -61 -55 -50 -45 -39  -4   4  13  22  30  39  48  57  66
      224 215 206 197 189 180 171 162 153 145 136 127  91  86  80 -69 -63 -58 -21 -12  -4   4  13  22  30  39  48  57  66  74
  224 215 206 197 189 180 171 162 153 145 136 127 118 110  72 -77 -39 -30 -21 -12  -4   4  13  22  30  39  48  57  66  74
  224 215 206 197 189 180 171 162 153 145 136 127 118 -59 -64  85  90 -30 -21 -12  -4   4  13  22  30  39  48  57  66  74
      215 206 197 189 180 171 162 153 145 136 -40 -45 -50 -56  93  99 104 109 -12  -4   4  13  22  30  39  48  57  66
      215 206 197 189 180 171 162 153 -21 -27 -32 -37 -42 -48 101 107 112 117 122 128   4  13  22  30  39  48  57  66
          206 197 189 180   2  -3  -8 -13 -18 -24 -29 -34 -39 110 115 120 125 131 136 141 146 152  30  39  48  57
          206 197  20  15  10   4   0  -5 -10 -16 -21 -26 -31 118 123 128 133 139 144 149 154 160 165 170  48  57
              34  28  23  18  13   7   2  -2  -7 -13 -18 -23 126 131 136 142 147 152 157 163 168 173 178 184
                  37  31  26  21  15  10   5   0  -5 -10 -15 134 139 144 150 155 160 165 171 176 181 187
                      39  34  29  24  18  13   8   2  -2  -7 142 147 152 158 163 168 174 179 184 189
                      42  37  32  26  21  16  11   5   0 150 155 161 166 171 176 182 187 192
                          40  35  29  24  19  13   8 158 163 169 174 179 185 190
                              37  32  27  22  16 166 172 177 182 187
```

ADD P POLARI AVERAGE AVERAGE
1
NONE RMS 0.81 PK-PK 3.01 FRED WAVEFRONT

FIGURE B11

Wavefront Plot-P Polarization

Task 2.1 - Nominal Cube -15° Off Axis

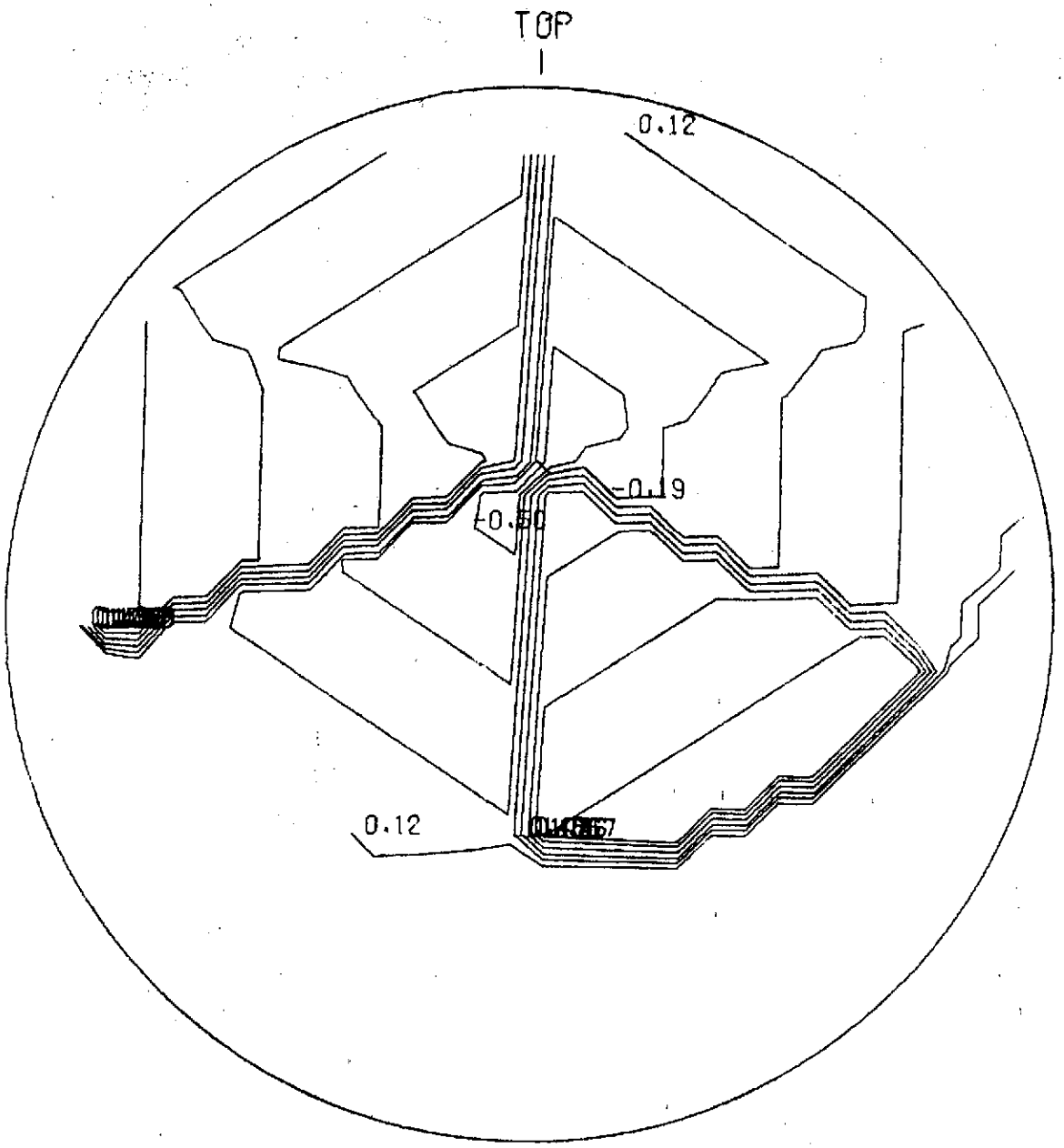


FIGURE B12

Task 2.1 - Nominal Cube -15° Off Axis

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0147 = 100
TOTAL ENERGY = 0.1870400D+01
MAP REPRESENTS 0.1736555D+01 OR 92.8440 PERCENT OF TOTAL ENERGY

```
 0  1  1  1  1  1  1  0  0  0  1  0  0  1  1  2  2  1  2  2  1  1  0  0  1  0  0  1  1  1  1  1  1  1  1  0
 0  0  0  1  1  1  1  0  1  1  1  0  0  0  1  2  2  1  2  2  1  0  0  0  1  1  1  0  1  1  1  1  0  0  0
 0  0  0  1  1  1  0  0  1  1  1  1  1  1  1  2  2  1  2  2  1  1  1  1  1  1  1  0  0  1  1  1  0  0  0
 0  0  1  1  1  0  0  1  1  2  3  2  1  0  1  3  3  2  3  3  1  0  1  2  3  2  1  1  0  0  1  1  1  0  0
 0  0  1  1  1  1  1  2  2  2  2  1  2  2  1  3  4  3  4  3  1  2  2  1  2  2  2  2  1  1  1  1  1  0  0
 0  0  0  0  1  1  2  3  2  1  2  4  6  3  3  5  3  2  3  5  3  3  6  4  2  1  2  3  2  1  1  0  0  0  0
 0  0  0  0  1  1  2  2  1  1  4  7  7  6 11 11  5  1  5 11 11  6  7  7  4  1  1  2  2  1  1  0  0  0  0
 1  1  1  1  1  1  3  1  0  2  5 10 15 20 25 18  8  5  8 18 25 20 15 10  5  2  0  1  3  1  1  1  1  1  1
 2  2  1  1  2  3  4  2  0  2  7 18 29 36 33 22 16 16 16 22 33 36 29 18  8  2  0  2  4  3  2  1  1  2  2
 3  2  1  1  2  4  4  2  1  4 15 26 35 41 38 30 26 25 26 30 38 42 35 26 15  4  1  2  4  4  2  1  1  2  3
 2  2  1  2  3  4  4  4  5 12 24 28 37 50 50 43 30 21 30 43 50 51 37 28 23 12  5  4  4  4  3  2  1  2  2
 2  2  2  4  4  4  3  6 12 22 30 32 50 67 60 48 30 18 31 48 60 67 50 31 30 22 12  6  3  4  4  4  2  2  2
 1  1  2  3  3  2  2  6 14 25 31 39 63 66 51 45 33 23 33 46 52 66 62 38 30 24 14  6  2  2  3  3  2  1  1
 1  1  1  1  1  1  1  4 10 19 26 42 58 47 45 48 29 16 29 48 44 46 57 41 26 19 10  4  1  1  1  1  1  1  1
 0  1  0  1  1  1  3  3  6 14 23 41 45 33 52 50 15  4 15 50 52 33 44 40 23 14  6  3  3  1  1  1  0  1  0
 0  0  1  1  1  1  3  3  6 14 22 34 31 24 47 32  9 18  9 31 46 24 30 34 22 14  6  3  3  1  1  1  1  0  0
 0  0  1  1  1  1  1  4  8 15 17 21 17 12 26 11  9 33  9 10 26 12 17 21 17 15  8  4  1  1  1  1  1  0  0
 0  0  1  2  2  1  1  5 10 15 11 11 14 13 31 27 13 17 13 27 31 14 14 11 11 14 10  5  1  1  2  2  1  0  0
 0  1  1  1  1  1  2  6  8 10  7 12 29 35 55 65 29  4 29 65 56 36 29 12  7 10  8  6  2  1  1  1  1  1  0
 0  1  1  1  1  1  3  5  4  4  8 24 56 65 64 70 43 18 43 70 64 65 57 25  8  4  4  5  3  1  1  1  1  1  0
 1  1  1  2  2  3  3  3  2  7 23 46 82 93 67 48 35 27 35 48 67 93 83 46 23  7  2  3  3  3  2  2  1  1  1
 1  1  1  2  2  3  2  3  4 15 40 62 86100 79 46 26 21 26 46 78100 86 62 41 15  4  3  2  3  2  2  1  1  1
 0  1  1  2  1  1  2  3  5 16 41 58 64 72 72 56 34 24 34 56 72 72 64 58 41 16  5  3  2  1  1  2  1  1  0
 1  1  1  1  1  2  3  3  4  9 25 41 43 40 44 45 36 29 36 45 44 40 42 41 25  9  4  3  3  2  1  1  1  1  1
 1  1  1  1  1  2  4  4  2  3  9 22 32 31 26 25 21 19 21 25 26 31 32 22  9  3  2  4  4  2  1  1  1  1  1
 0  1  0  0  1  2  4  3  1  0  2  8 20 26 23 16  9  6  9 16 23 26 20  8  2  0  1  3  4  2  1  0  0  1  0
 0  0  0  0  1  1  2  3  1  1  3  4  6 11 15 12  5  1  4 12 15 11  6  4  3  1  1  3  2  1  1  0  0  0  0
 0  0  0  0  1  1  1  3  4  3  3  4  3  2  4  6  3  1  3  6  4  2  3  4  3  3  4  3  1  1  1  0  0  0  0
 0  0  0  0  1  1  1  3  4  4  2  3  2  1  1  3  3  2  3  3  1  1  2  3  2  4  4  3  1  1  1  0  0  0  0
 0  0  0  1  1  1  0  1  2  3  2  1  0  0  1  3  4  3  4  3  1  0  0  1  2  3  2  1  0  1  1  1  0  0  0
 0  0  0  1  1  1  0  0  0  2  2  2  1  0  2  4  3  2  3  3  2  0  1  2  2  2  0  0  0  1  2  1  0  0  0
 0  0  0  1  2  1  1  0  0  1  1  2  1  1  2  3  3  2  3  3  2  1  1  2  1  1  0  0  1  1  2  1  0  0  0
 0  0  1  0  1  2  2  1  1  1  0  0  0  1  1  2  2  2  2  2  1  1  0  0  0  1  1  1  2  2  1  0  1  0  0
 0  0  1  1  1  1  2  1  0  1  1  0  0  0  1  1  1  1  1  1  1  0  0  0  1  1  0  1  2  1  1  1  1  0  0
-1D
 1D
```

ID
ID
NONE RMS 2.08 PK-PK 9.66 FRED WAVEFRONT

FIGURE B13

Intensity Distriubtion - Central 129 Microradians

Task 2.1 - Nominal Cube -15° Off Axis

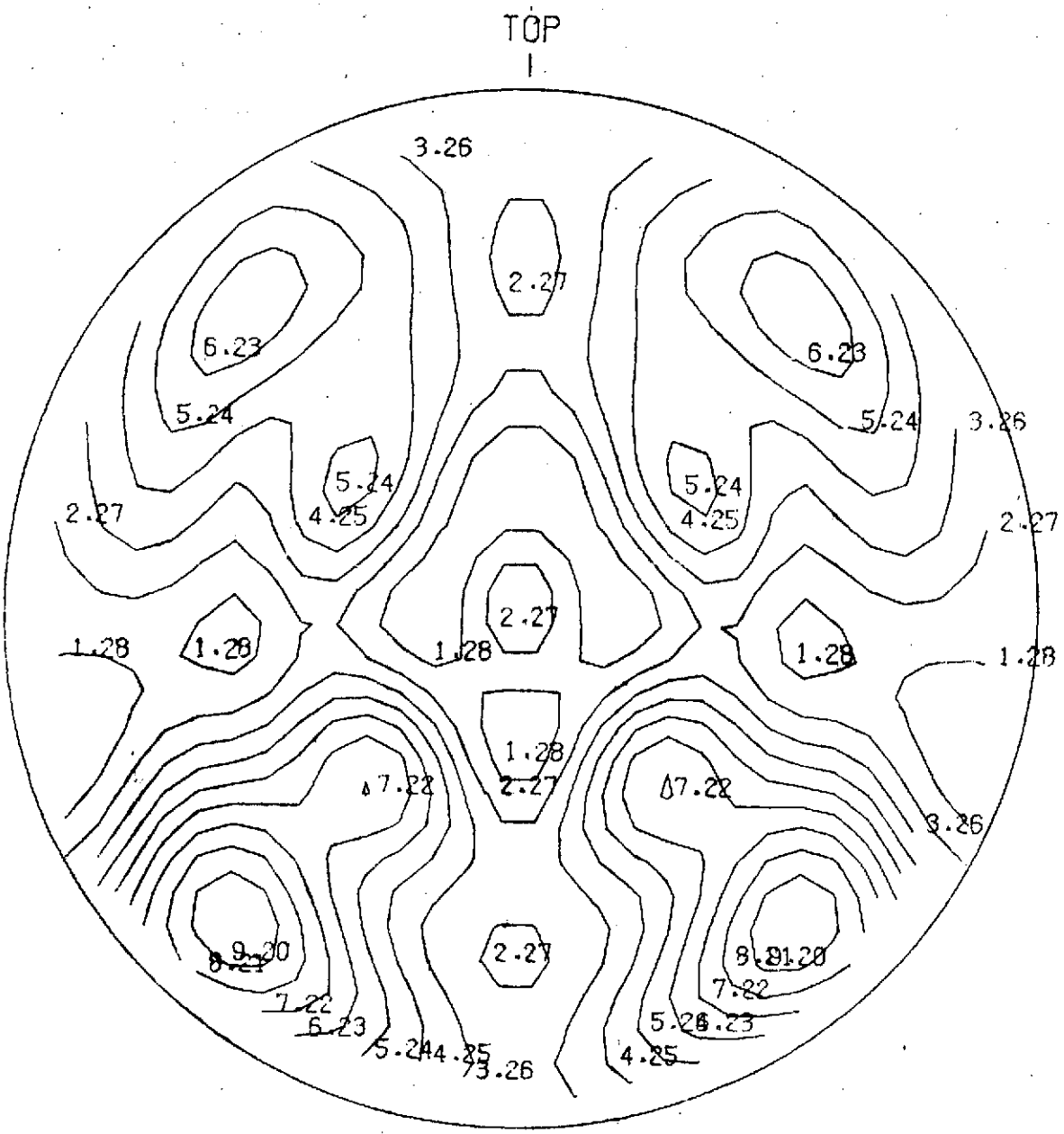


FIGURE B14

Encircled Energy
Vs
Field Angle

Task 2.1 - Nominal Cube -15° Off Axis

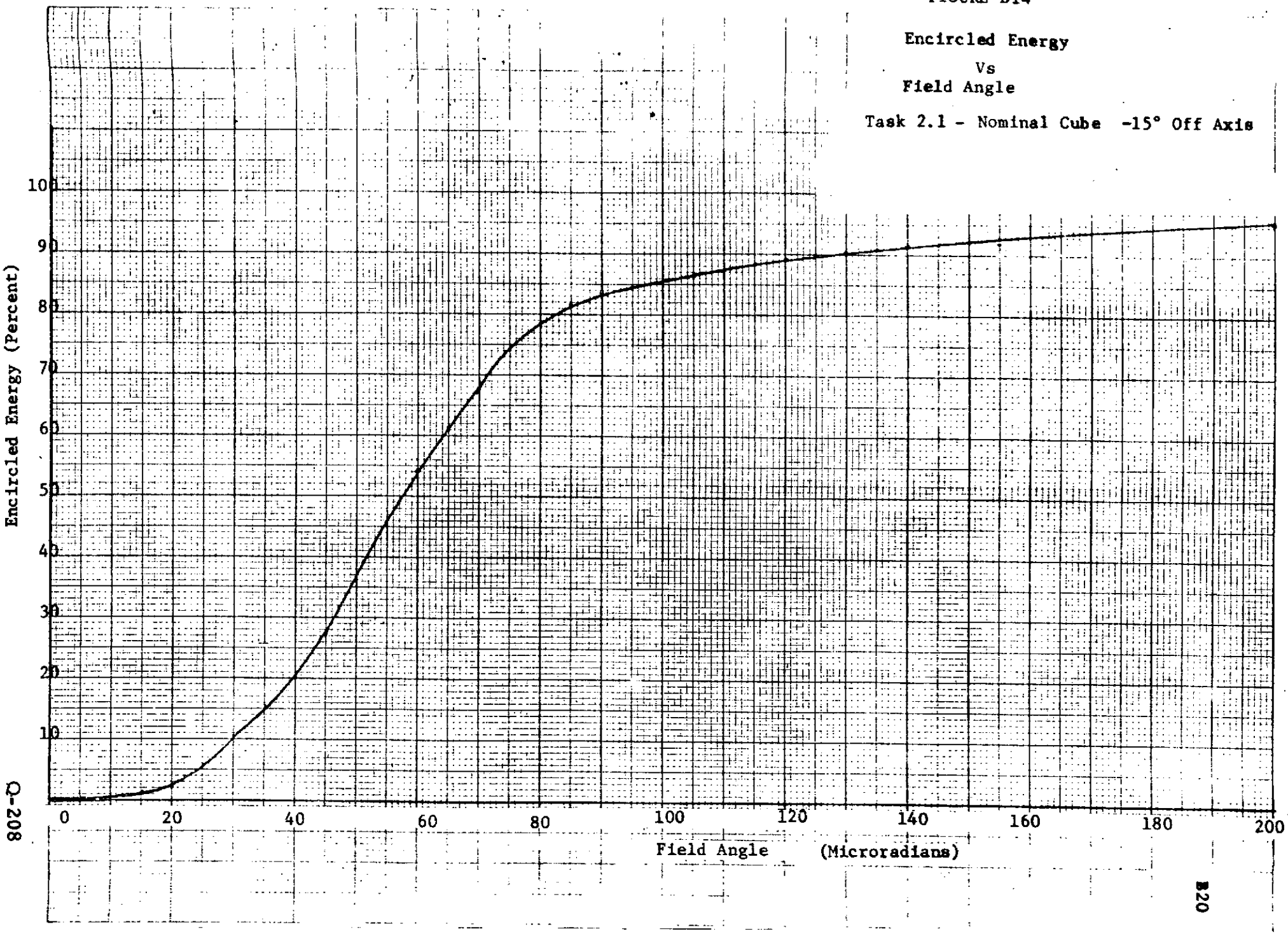


TABLE B6

ENCIRCLED ENERGY

Task 2.2 - Nominal + Mfg. Error - On Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.00	0.1	0.1	0.0	0.1	0.0	0.1	0.0	0.0	0.1
6.00	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.0	0.1
8.00	0.3	0.2	0.1	0.4	0.2	0.3	0.2	0.2	0.3
10.00	0.5	0.3	0.2	0.5	0.4	0.4	0.3	0.3	0.4
12.00	0.9	0.7	0.4	0.7	0.5	0.6	0.5	0.7	0.8
14.00	0.9	0.7	0.8	0.9	0.7	0.9	0.8	0.7	0.8
16.00	1.5	1.3	1.1	1.1	0.9	1.1	1.1	1.2	1.2
18.00	1.7	1.5	1.5	1.3	1.5	1.3	1.5	1.5	1.5
20.00	2.3	2.2	2.2	1.7	1.5	1.8	2.2	2.3	2.2
22.00	2.7	2.5	2.9	2.2	2.2	2.1	2.7	2.6	2.5
24.00	3.7	3.7	3.6	2.7	2.6	2.7	3.4	3.8	3.7
26.00	4.3	4.2	4.4	3.4	3.4	3.4	4.3	4.5	4.4
28.00	6.0	6.2	5.9	4.5	3.7	4.5	6.0	6.4	6.2
30.00	7.0	7.2	6.8	5.7	5.2	5.7	7.0	7.6	7.3
32.00	9.2	9.7	8.4	6.8	6.0	6.8	8.8	10.2	9.6
34.00	9.7	10.3	9.9	9.0	8.1	8.9	10.6	10.8	10.2
36.00	12.2	13.1	11.8	10.5	9.9	10.4	12.9	13.8	12.9
38.00	13.6	14.5	13.8	12.9	13.3	12.9	14.9	15.5	14.4
40.00	16.2	17.4	16.2	15.0	14.9	14.9	17.6	18.6	17.2
42.00	17.4	18.6	19.0	18.4	19.3	18.4	20.4	20.0	18.6
44.00	20.8	22.1	21.5	20.5	21.4	20.4	23.0	23.7	22.2
46.00	23.3	24.5	24.6	24.8	26.1	24.7	26.1	26.2	24.7
48.00	27.0	28.1	28.6	28.4	27.5	28.1	30.1	30.0	28.4
50.00	30.1	31.0	31.0	31.6	32.3	31.4	32.6	33.1	31.6
52.00	34.2	34.9	34.8	35.2	35.0	34.9	36.4	37.0	35.6
54.00	36.4	37.2	37.8	39.1	39.8	38.8	39.6	39.2	37.8
56.00	40.7	41.2	42.3	42.9	42.9	42.7	44.0	43.0	41.9
58.00	43.8	44.3	45.0	45.9	48.0	45.7	46.8	46.0	45.0
60.00	47.2	47.7	48.9	49.6	51.5	49.4	50.5	49.2	48.5
62.00	49.7	50.0	52.2	53.6	55.6	53.4	53.7	51.3	50.9
64.00	54.0	54.1	55.1	56.2	58.7	56.1	56.4	55.1	55.1
66.00	56.5	56.6	58.5	60.2	62.4	60.1	59.5	57.5	57.5
68.00	60.3	60.1	61.5	62.6	64.1	62.6	62.1	60.8	61.1
70.00	62.5	62.2	64.2	65.6	67.0	65.6	64.6	62.8	63.2
72.00	65.9	65.4	66.6	67.7	69.4	67.7	66.8	65.7	66.3
74.00	67.6	67.0	69.2	70.0	71.4	70.1	69.2	67.2	67.9
76.00	70.4	69.6	71.5	71.8	73.0	71.9	71.4	69.8	70.5
78.00	72.2	71.3	72.8	73.2	74.8	73.3	72.8	71.4	72.2
80.00	74.1	73.1	74.7	74.8	76.0	74.9	74.7	73.1	74.1

TABLE B7

E N C I R C L E D E N E R G Y

Task 2.2 - Nominal + Mfg. Error - On Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.1	0.1	0.0	0.2	0.1	0.2	0.1	0.0	0.1
10.00	0.5	0.3	0.2	0.5	0.4	0.4	0.3	0.3	0.4
15.00	1.2	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0
20.00	2.3	2.2	2.2	1.7	1.5	1.8	2.2	2.3	2.2
25.00	4.1	4.1	4.1	3.3	2.9	3.2	4.0	4.3	4.1
30.00	7.0	7.2	6.8	5.7	5.2	5.7	7.0	7.6	7.3
35.00	11.1	12.0	10.8	9.3	9.4	9.3	11.6	12.6	11.8
40.00	16.2	17.4	16.2	15.0	14.9	14.9	17.6	18.6	17.2
45.00	22.2	23.4	23.1	23.4	24.2	23.2	24.6	25.1	23.5
50.00	30.1	31.0	31.0	31.6	32.3	31.4	32.6	33.1	31.6
55.00	39.2	39.8	40.3	40.9	42.1	40.6	42.0	41.6	40.5
60.00	47.2	47.7	48.9	49.6	51.5	49.4	50.5	49.2	48.5
65.00	55.2	55.2	57.2	58.7	60.9	58.5	58.3	56.2	56.2
70.00	62.5	62.2	64.2	65.6	67.0	65.6	64.6	62.8	63.2
75.00	69.2	68.5	70.4	71.0	72.3	71.0	70.4	68.7	69.4
80.00	74.1	73.1	74.7	74.8	76.0	74.9	74.7	73.1	74.1
85.00	77.6	76.5	78.0	78.2	78.9	78.3	78.2	76.6	77.7
90.00	80.3	79.4	80.4	80.8	81.0	80.8	80.6	79.6	80.5
95.00	82.6	82.1	82.5	82.8	82.9	82.8	82.6	82.2	82.7
100.00	84.3	84.0	84.3	84.5	84.7	84.6	84.4	84.1	84.4
105.00	85.6	85.7	85.9	86.1	86.4	86.2	86.1	85.7	85.8
110.00	87.0	87.2	87.4	87.4	87.8	87.5	87.4	87.3	87.1
115.00	88.2	88.6	88.6	88.5	88.9	88.6	88.6	88.5	88.3
120.00	89.3	89.6	89.6	89.5	89.8	89.6	89.6	89.5	89.3
125.00	90.1	90.4	90.5	90.4	90.6	90.4	90.5	90.4	90.1
130.00	90.9	91.1	91.1	91.1	91.2	91.1	91.1	91.1	90.9
135.00	91.7	91.6	91.7	91.7	91.8	91.6	91.6	91.6	91.6
140.00	92.2	92.2	92.2	92.3	92.2	92.3	92.2	92.1	92.1
145.00	92.6	92.7	92.7	92.7	92.7	92.7	92.7	92.7	92.6
150.00	93.0	93.1	93.1	93.2	93.2	93.2	93.1	93.1	93.0
155.00	93.4	93.5	93.5	93.5	93.6	93.5	93.5	93.5	93.4
160.00	93.8	93.8	93.9	93.8	93.9	93.8	93.9	93.9	93.8
165.00	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2
170.00	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.4	94.5
175.00	94.8	94.8	94.8	94.8	94.7	94.8	94.8	94.7	94.8
180.00	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1
184.99	95.3	95.4	95.3	95.4	95.4	95.4	95.4	95.4	95.4
189.99	95.6	95.6	95.6	95.7	95.7	95.7	95.7	95.6	95.6
194.99	95.9	95.9	95.9	95.9	95.9	95.9	95.9	95.9	95.9
199.99	96.1	96.1	96.1	96.2	96.1	96.2	96.1	96.2	96.2

FIGURE B15

Wavefront Map-0 Polarization

Task 2.2 - Nominal + Mfg. Error - On Axis

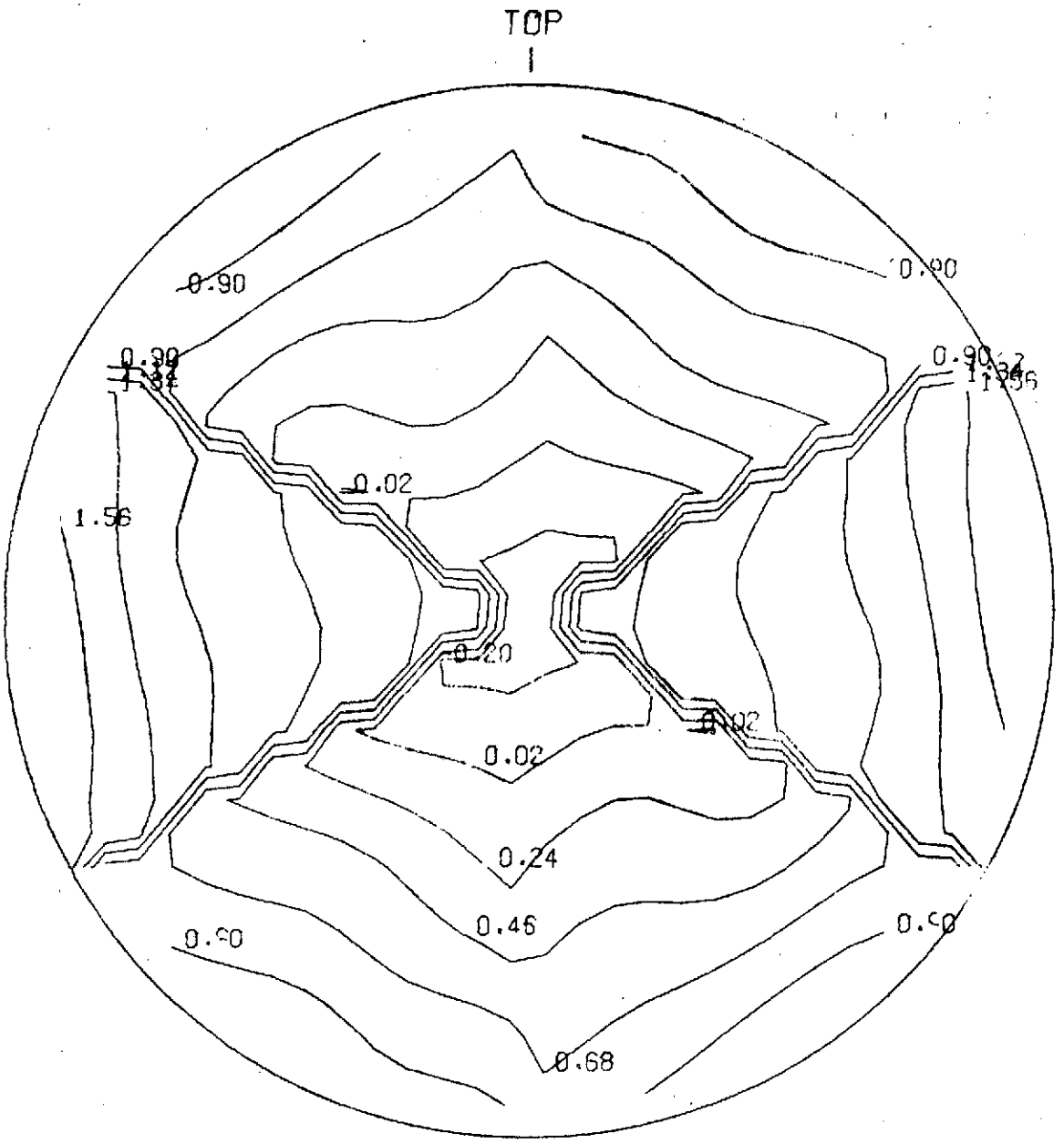
MAP IN UNITS OF 0.01 WAVES

```
                                                100  93  86  81  78  89  92  94  96 100
                                        115 107  98  90  84  78  72  67  83  87  88  90  94 102 112 121
                                    113 105  96  88  81  75  70  65  59  74  78  80  83  87  95 104 112 118
                                109 102  94  85  78  72  68  64  59  53  61  67  70  74  79  86  94 100 104 108
                            102  97  90  82  74  67  63  60  57  53  48  48  55  60  64  70  77  83  87  90  93  97
                        93  90  85  78  69  62  56  54  52  51  48  42  36  43  50  56  62  68  73  76  78  81  86  91
                    83  81  79  73  65  57  50  46  45  45  44  41  36  27  34  41  49  56  61  65  67  69  72  76  82  88
                143  74  71  68  62  53  44  38  36  37  38  38  34  28  19  26  33  41  48  54  57  59  61  64  68  74  80 162
                143 135 128  58  51  42  33  28  27  29  32  31  27  21  12  18  25  32  38  43  47  50  53  56  60 140 152 161
                144 136 128 120  43  33  23  18  18  21  24  23  19  12   5  10  15  20  25  30  35  40  44  48 126 139 151 161
            156 147 137 127 118 109 100  15  10  10  12  14  14  10   3  -1   1   4   7  11  17  23  30 102 113 126 139 151 162 170
            163 149 137 126 115 106  99  91  82   1   2   3   3   0  -6 -10  -7  -6  -4  -1   4  84  93 102 113 125 138 151 163 172
            164 152 138 124 113 104  98  92  84  76  71  -7  -8 -10 -14 -18 -17 -16 -15  74  81  89  96 104 114 124 136 149 162 173
            168 155 140 125 113 104  99  94  87  80  74  70 -18 -19 -22 -28 -26 -26  69  77  85  92  99 106 113 121 133 147 161 174
            171 157 142 127 115 107 102  96  90  83  77  71  63  53 -30 -39  48  60  70  78  85  92  99 104 110 118 130 145 160 173
            173 160 145 130 118 110 104  99  92  85  78  70  63  48 -39 -30  53  63  71  77  83  90  96 102 107 115 127 142 157 171
            174 161 147 133 121 113 106  99  92  85  77  69 -26 -26 -28 -22 -19 -18  70  74  80  87  94  99 104 113 125 140 155 168
            173 162 149 136 124 114 104  96  89  81  74 -15 -16 -17 -18 -14 -10  -8  -7  71  76  84  92  98 104 113 124 138 152 164
            172 163 151 138 125 113 102  93  84   4  -1  -4  -6  -7 -10  -6   0   3   3   2   1  82  91  99 106 115 126 137 149 160
            170 162 151 139 126 113 102  30  23  17  11   7   4   1  -1   3  10  14  14  12  10  10  15 100 109 118 127 137 147 156
                161 151 139 126  48  44  40  35  30  25  20  15  10   5  12  19  23  24  21  18  18  23  33  43 120 128 136 144
                161 152 140  60  56  53  50  47  43  38  32  25  18  12  21  27  31  32  29  27  28  33  42  51  58 128 135 143
            162  80  74  68  64  61  59  57  54  48  41  33  26  19  28  34  38  38  37  36  38  44  53  62  68  71  74 143
                88  82  76  72  69  67  65  61  56  49  41  34  27  36  41  44  45  45  46  50  57  65  73  79  81  83
                    91  86  81  78  76  73  68  62  56  50  43  36  42  48  51  52  54  56  62  69  78  85  90  93
                        97  93  90  87  83  77  70  64  60  55  48  48  53  57  60  63  67  74  82  90  97 102
                        108 104 100  94  86  75  74  70  67  61  53  59  64  68  72  78  85  94 102 109
                            118 112 104  95  87  83  80  78  74  59  65  70  75  81  88  96 105 113
                        121 112 102  94  90  88  87  83  67  72  78  84  90  98 107 115
                                100  96  94  92  89  76  81  86  93 100
```

FIGURE B16

Wavefront Plot-Q Polarization

Task 2.2 - Nominal + Mfg. Error - On Axis



Wavefront Map-P Polarization

Task I.2 - Nominal + Mfg. Error - On Axis

MAP IN UNITS OF 0.01 WAVES

```
                                                208 201 195 190 185  48  51  52  54  58
                                            224 215 207 199 192 186 181 175  42  45  47  49  53  60  70  80
                                        221 213 205 197 190 184 179 174 168  32  37  39  41  46  54  62  71  77
                                    218 210 202 194 186 180 176 172 168 162  20  25  29  32  38  45  52  58  63  66
                                211 206 199 190 182 176 171 168 166 162 156   6  13  18  23  29  35  41  45  49  52  55
                            201 195 194 186 178 170 165 162 161 159 156 151  -4   2   8  14  21  27  32  35  37  40  44  49
                        191 190 187 182 174 165 158 154 153 154 153 150 144 -14  -7   0   7  14  20  24  26  28  31  35  41  47
                    209 182 180 176 170 162 153 147 145 146 147 146 143 137 -22 -15  -7   0   7  12  16  18  20  22  26  32  39  78
                209 201 194 187 180 150 142 136 136 138 140 139 135 129 -29 -23 -16  -9  -2   2   6   9  11  14  18  56  68  77
            210 202 194 186 151 141 132 127 127 130 132 132 127 121 -36 -31 -26 -21 -15 -10  -5  -1   3   6  42  55  67  77
        222 213 203 193 184 175 166 124 118 118 121 123 122 118 111 -43 -39 -37 -33 -29 -24 -17 -11  18  29  42  55  67  78  86
        226 215 203 192 181 172 165 157 148 109 110 112 111 108 102 -51 -49 -47 -46 -42 -36   0   9  18  29  41  54  67  79  88
        233 218 204 190 179 170 164 158 150 142 137 100 100  67  93 -60 -58 -58 -57  -9  -2   5  12  20  30  40  52  65  78  89
        234 221 206 191 179 170 165 160 153 146 140 136  93  88  85 -70 -68 -67 -15  -6   1   8  15  22  29  37  49  63  77  90
        237 223 208 193 181 173 168 162 156 149 143 137 129 119  77 -80 -35 -23 -13  -5   1   8  15  20  26  34  46  60  76  89
        239 226 210 196 184 176 170 165 158 151 144 136 126 114 -69  89 -30 -20 -12  -6   0   6  12  18  23  31  43  58  73  87
        240 227 213 199 187 179 172 165 158 151 143 134 -56 -56 -58  97 100 101 -13  -9  -3   3  10  15  20  29  41  56  71  84
        239 228 215 202 190 180 170 162 155 147 140 -45 -46 -47 -48 105 109 112 112 -12  -7   0   8  14  20  29  40  54  68  80
        238 229 217 204 191 179 168 159 150 -25 -31 -34 -36 -37 -40 114 120 123 124 122 121  -1   7  15  22  31  42  53  65  76
        236 228 217 205 192 179 168   0  -6 -12 -18 -22 -25 -28 -31 123 130 134 135 132 130 130 135  16  25  34  43  53  63  72
      227 217 205 192  18  14  10   5   0  -4  -9 -14 -19 -24 132 139 143 144 142 139 138 144 153 163  36  44  52  60
      227 218 206  30  26  23  20  17  13   8   2  -4 -11 -17 141 147 151 152 150 147 148 153 162 171 178  44  51  59
      228  50  44  38  34  31  29  27  24  18  11   3  -3 -10 149 154 158 159 157 156 158 165 173 182 188 191 194  59
        58  52  46  42  39  37  35  32  26  19  11   4  -2 156 161 165 166 165 166 170 177 186 194 199 201 203
          61  56  51  48  46  43  38  32  26  20  13   6 162 168 171 173 174 176 182 190 198 206 211 213
            67  63  60  57  53  47  40  34  30  25  18 168 174 178 180 183 187 194 202 210 218 222
              78  74  70  64  56  49  44  40  37  31 174 179 184 188 192 198 206 214 222 229
                88  82  74  65  57  53  50  48  44 180 185 191 196 201 208 216 225 233
                  91  82  72  64  60  58  57  53 187 192 198 204 210 218 227 236
                    73  66  64  62  59 196 201 206 213 220
```

FIGURE B18

Wavefront Plot-P Polarization

Task 2.2 - Nominal + Mfg. Error - On Axis

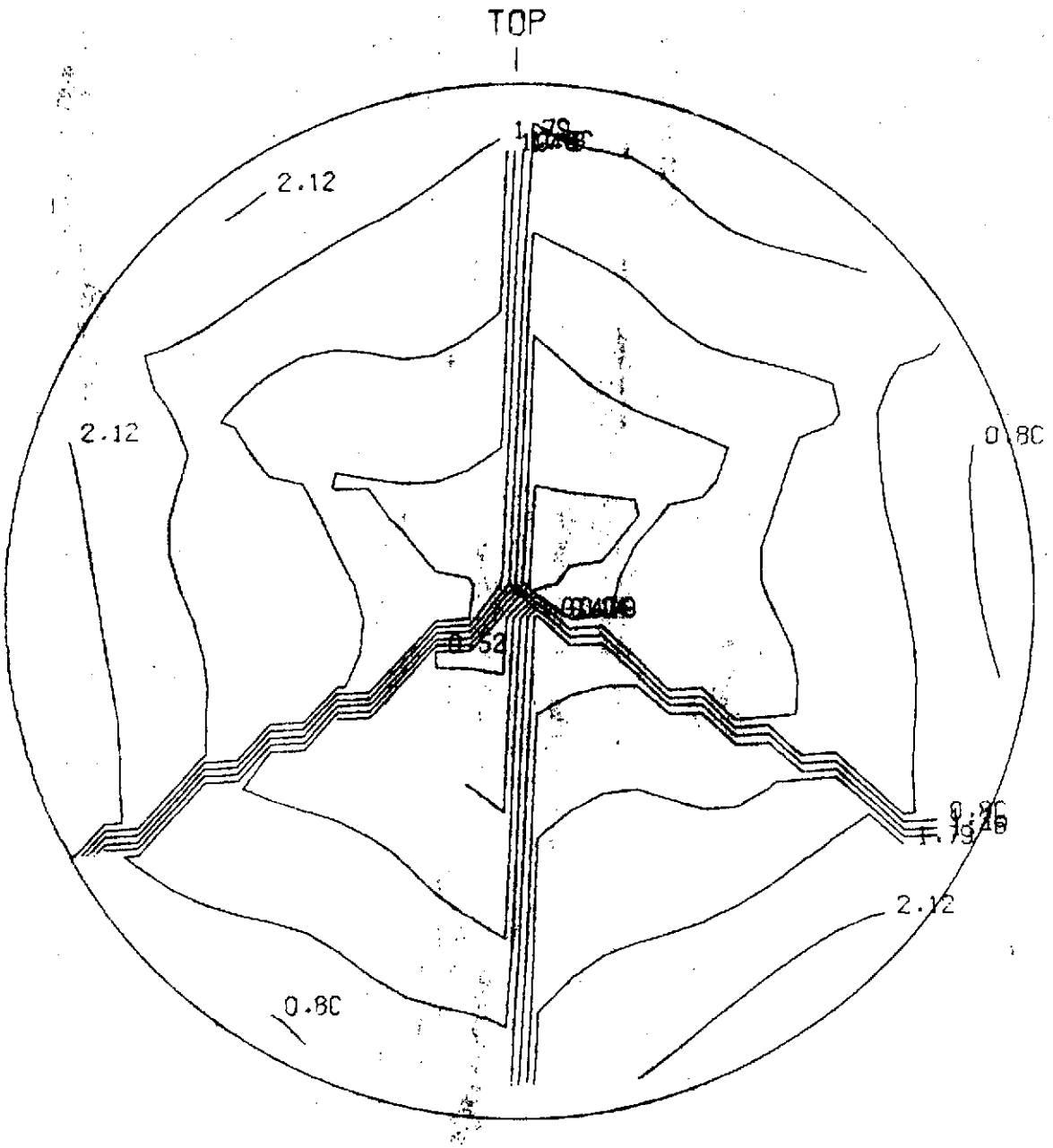


FIGURE B19

Task 2.2 - Nominal + Mfg. Error - On Axis

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0181 = 100
TOTAL ENERGY = 0.24610000+01
MAP REPRESENTS 0.2306J43D+01 OR 93.7035 PERCENT OF TOTAL ENERGY

```
 1  1  1  1  0  0  1  1  1  0  1  1  2  2  1  1  0  1  0  0  1  2  1  1  1  1  1  0  0  1  1  1  1  1
 1  1  1  1  0  0  1  1  1  1  1  0  1  1  3  3  1  0  0  1  3  4  2  1  1  1  1  1  0  0  1  1  1  1
 0  1  1  0  0  0  1  1  1  1  0  0  1  1  2  3  2  2  2  1  2  3  3  2  1  2  1  1  1  0  1  0  1  1
 0  0  0  0  0  1  1  1  1  2  2  1  1  0  1  2  3  4  3  1  3  2  2  2  1  1  1  1  1  1  1  1  0  0
 0  0  0  1  1  0  1  1  2  4  4  3  3  2  2  4  4  4  4  2  1  2  3  3  2  1  1  1  1  2  1  1  0  0
 0  0  0  1  1  0  1  1  2  6  6  6  5  3  3  6  9 11  8  4  3  2  3  3  2  2  0  0  1  1  1  1  0  0
 0  0  1  1  1  1  1  2  5  8  7  9  8  4  4  4 10 16  9  5  7  4  4  4  2  1  1  1  2  1  1  1  0  0
 1  0  1  1  1  2  2  5  8  8 10 12  9  8  8  6  9 13  9 10 14  9  5  7  3  0  2  2  1  1  1  1  0  0
 1  0  1  1  1  1  3  4  6  9 12  9 10 15 15 16 16 16 20 26 32 27 14  8  3  1  3  2  1  1  0  0  1  1
 0  0  1  1  1  2  3  2  3  7  7 11 23 28 32 38 37 39 45 47 48 45 31 16  6  3  4  2  2  1  0  0  1  2
 0  0  0  1  3  4  3  2  1  1  6 20 27 34 56 58 47 55 64 71 70 54 39 25 13  7  3  1  2  2  1  1  0  1
 1  1  2  2  3  5  5  5  3  2  9 23 31 52 74 59 54 72 69 77 94 80 51 33 21 10  5  3  2  1  1  2  2  2
 1  2  2  1  2  5  7  6  4  4  5 20 40 64 67 60 81100 79 64 81 76 48 35 22 10  7  6  4  1  1  2  2  2  1
 1  1  1  1  2  4  4  4  4  4 10 15 26 40 47 56 60 59 56 48 53 47 34 39 26 12 11  5  6  4  4  4  1  1  1
 1  0  0  2  3  3  1  4  7  7 12 15 18 22 33 38 21 15 28 28 25 29 36 45 31 23 21  6  7  8  7  4  1  2  1
 1  0  1  2  3  5  3  5  9 15 21 17 17 12 18 22  8  6 15 17  6 18 38 35 27 27 24 12  9  8  7  6  3  3  1
 1  1  1  4  5  8  6  6  9 24 33 18 23 16 15 26 14  3  4 16 14 39 51 28 29 25 18 14  9  7  7  7  5  3  1
 1  2  2  6  7  8  6  9 11 24 38 27 42 34 13 20 17 17 14 14 15 45 48 25 36 24 11  9  6  8  6  6  3  2  2
 1  3  4  6  5  7  6 13 18 24 42 40 43 29  4  7  2  4 16 17  8 17 20 25 43 25 10  4  3  7  5  4  1  1  1
 1  2  3  5  4  5  7 13 27 25 31 31 20 14  7 15 16  8 12 15  8  5  3 12 25 17 14  6  1  3  1  2  1  0  0
 0  1  2  5  3  4  8 16 22 15 11 20 22 37 39 31 27 19 21 30 33 26 11  5  4  4 10  7  3  2  1  2  1  1  0
 0  1  2  4  3  2  7  5  6  3 12 38 54 75 81 66 57 59 66 69 63 48 31 21 10  1  2  3  4  5  3  1  1  1  1
 1  2  1  2  1  1  3  3  2  6 23 52 76 91 89 79 85100 95 78 69 60 43 26 13  5  2  1  3  5  3  2  1  0  1
 1  2  3  1  0  0  1  4  8 15 27 45 72 96100 84 74 73 70 77 83 66 40 19  8  6  6  3  1  1  2  3  2  1  1
 1  1  2  1  1  1  3  4  7 11 16 27 46 72 90 85 68 54 53 68 68 46 27 12  3  3  5  4  2  2  1  1  1  0  1
 1  1  0  0  0  2  4  4  3  2  3 13 27 40 46 46 43 39 34 33 30 25 20 10  6  7  6  5  5  4  1  0  0  0  1
 1  1  1  1  1  2  3  3  2  1  3  8 15 23 25 23 20 16 16 17 17 16 13 12 13 12  9  7  6  4  1  1  1  0  1
 0  0  0  1  1  1  1  1  2  2  5  7  6  9 13 16 15 13 12 11 10  8  9 12 13 10  8  6  4  2  1  1  0  0  1
 0  1  0  0  1  1  1  1  1  2  4  5  4  4  5  5 10 16 11  4  4  5  8 10  9  7  4  2  1  1  1  1  0  0  0
 0  0  0  1  1  2  2  1  0  1  2  3  2  2  3  3  7 11  9  5  3  2  4  5  5  4  1  0  0  1  1  1  1  0  0
 0  0  0  1  2  2  2  2  1  1  1  1  1  2  2  3  4  4  5  4  2  2  2  2  3  2  2  1  1  1  1  1  1  1  0
 0  0  1  1  1  1  2  2  2  1  1  1  2  3  2  3  4  4  3  2  1  1  1  1  2  2  2  1  1  1  1  1  1  1  0
 0  1  1  0  0  0  1  1  2  2  1  2  3  2  1  1  2  2  2  2  2  1  1  1  1  1  1  1  1  0  0  0  1  1  0
 1  1  1  1  1  1  1  1  1  1  1  2  2  2  2  0  0  1  3  3  1  1  0  0  1  1  0  0  0  0  1  1  1  1
 0  1  2  2  1  1  1  1  0  1  1  1  1  2  2  2  1  1  1  0  1  2  2  1  0  1  0  1  1  1  0  1  1  1  1  1
ID
ID
```

FIGURE B20

Intensity Distriubtion - Central 129 Microradians

Task 2.2 - Nominal + Mfg. Error - On Axis

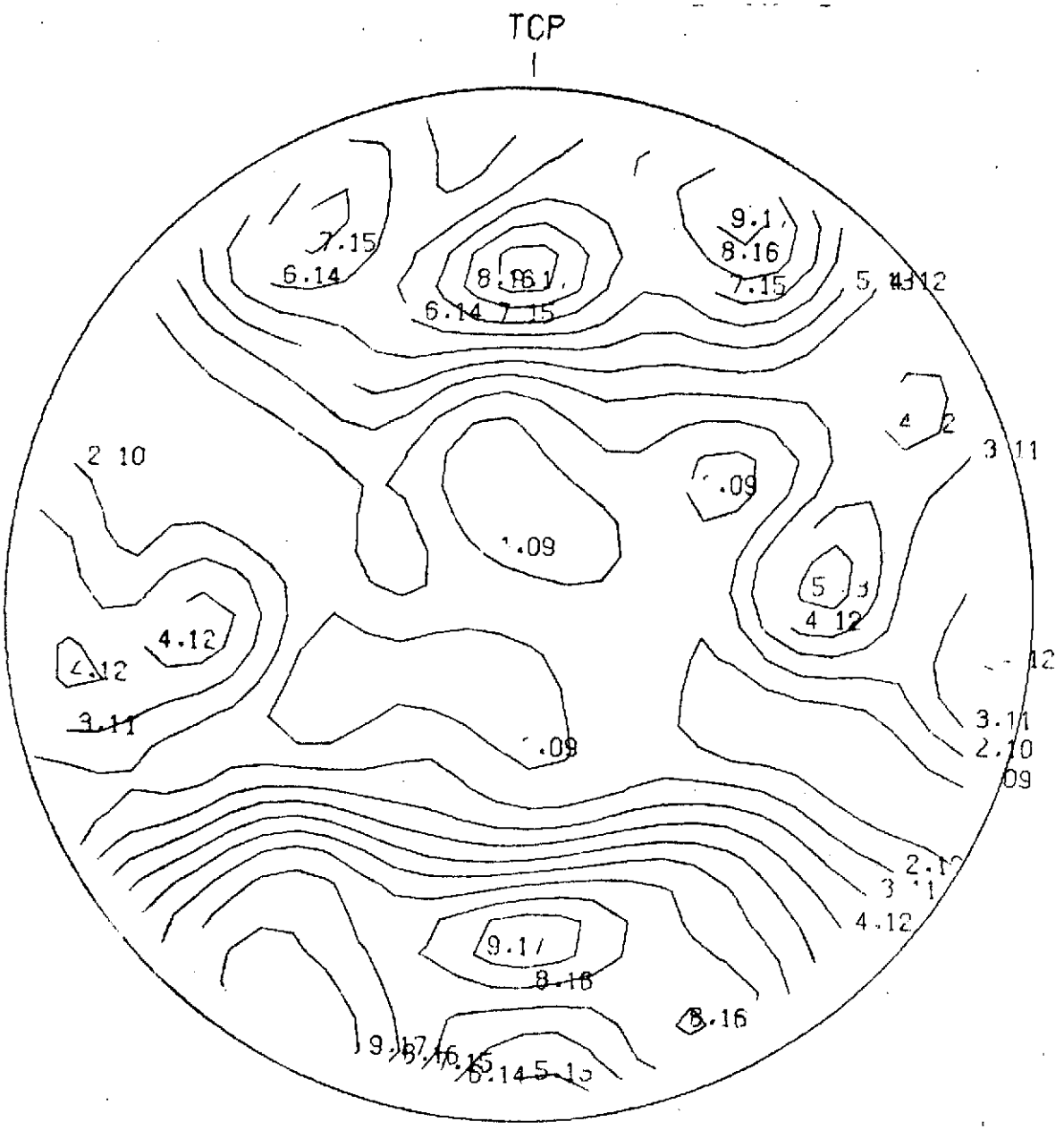


FIGURE B21

Encircled Energy
Vs
Field Angle

Task 2.2 - Nominal

+ Mfg. Error - On Axis

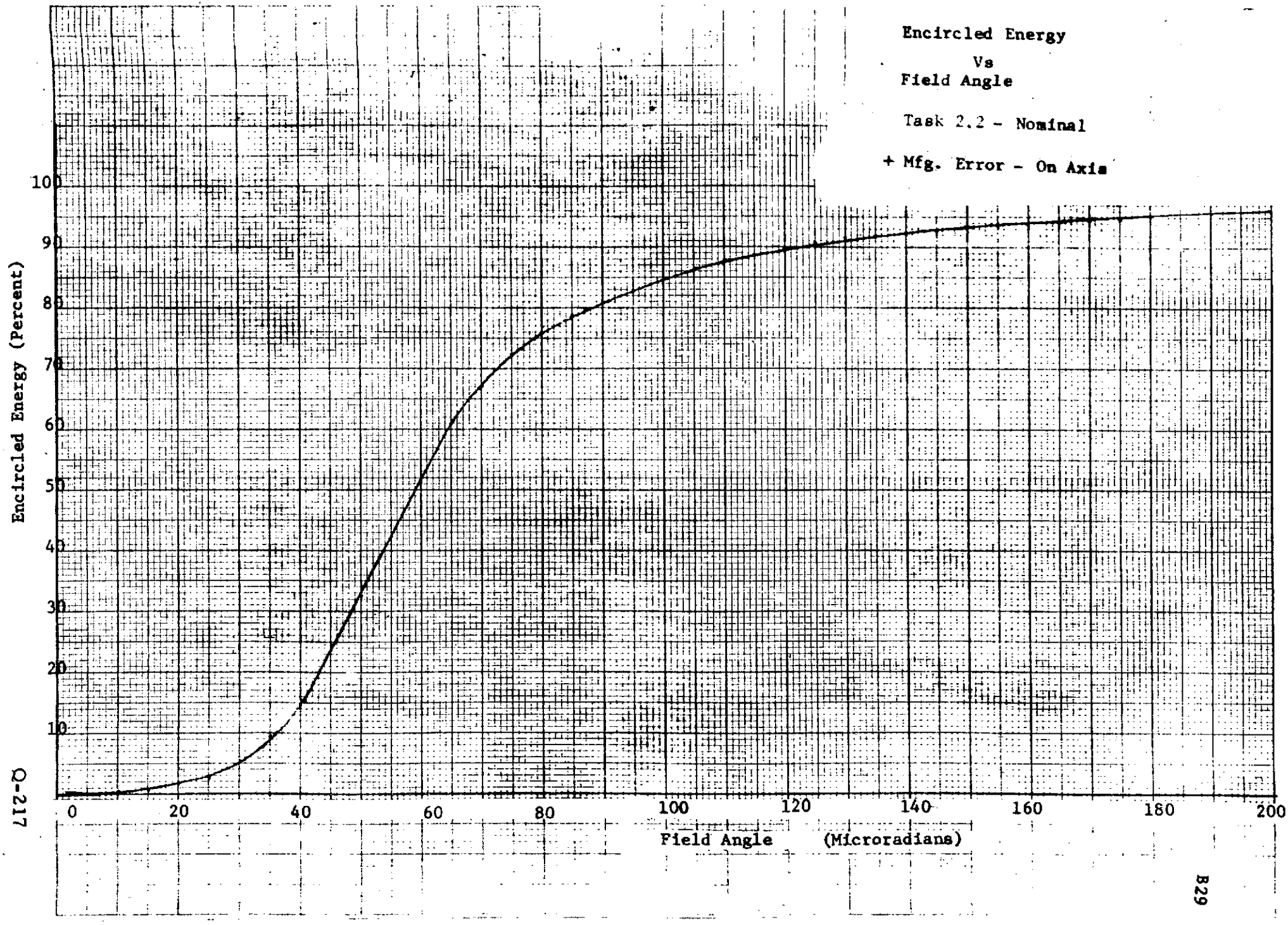


TABLE B8

ENCIRCLED ENERGY

Task 2.2 - Nominal + Mfg. Error -15° Off Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.00	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1
6.00	0.1	0.1	0.1	0.2	0.3	0.2	0.1	0.1	0.1
8.00	0.3	0.4	0.2	0.4	0.3	0.3	0.2	0.5	0.5
10.00	0.5	0.6	0.2	0.5	0.5	0.5	0.3	0.7	0.7
12.00	1.2	1.3	0.4	1.0	0.5	1.0	0.5	1.5	1.5
14.00	1.2	1.3	0.8	1.5	0.7	1.5	1.1	1.5	1.5
16.00	2.1	2.3	1.1	2.1	1.0	2.1	1.4	2.7	2.5
18.00	2.6	2.7	1.7	2.7	1.9	2.7	2.2	3.2	3.0
20.00	3.4	3.6	2.4	3.5	1.9	3.5	2.9	4.2	4.0
22.00	3.8	4.0	3.6	4.4	3.5	4.4	4.2	4.8	4.5
24.00	5.0	5.1	4.1	5.0	4.5	4.9	4.8	6.1	5.8
26.00	5.7	5.8	5.7	6.2	6.5	6.1	6.5	6.9	6.6
28.00	7.3	7.3	7.3	7.7	7.2	7.6	8.2	8.6	8.3
30.00	8.6	8.7	8.8	9.1	9.4	8.9	9.8	10.0	9.7
32.00	11.2	11.2	10.0	10.7	10.8	10.5	11.1	12.5	12.3
34.00	11.8	11.8	12.1	12.9	12.2	12.6	13.4	13.1	12.9
36.00	14.9	14.8	13.8	15.1	14.6	14.9	15.1	16.0	15.9
38.00	16.7	16.6	15.9	17.2	16.9	17.0	17.2	17.9	17.7
40.00	19.5	19.4	18.2	19.9	18.5	19.7	19.6	20.7	20.4
42.00	21.0	20.9	21.3	22.8	21.4	22.7	22.7	22.3	22.0
44.00	24.1	24.1	22.9	24.4	24.2	24.3	24.5	25.5	25.2
46.00	26.6	26.5	26.8	27.7	28.1	27.6	28.4	28.4	28.1
48.00	29.2	29.2	29.8	30.8	29.7	30.7	31.9	31.2	30.8
50.00	32.2	32.1	32.6	33.2	34.0	33.0	34.4	34.5	34.2
52.00	35.2	35.2	35.3	36.1	37.3	35.9	37.7	37.8	37.4
54.00	37.2	37.1	38.8	39.4	40.6	39.1	41.1	39.8	39.6
56.00	40.7	40.6	42.2	43.3	44.1	43.0	44.9	43.3	43.1
58.00	43.8	43.7	44.6	45.8	47.6	45.5	47.1	46.5	46.4
60.00	46.8	46.7	48.0	49.5	50.8	49.3	50.8	49.2	49.3
62.00	49.3	49.1	51.3	52.7	53.6	52.6	53.8	51.6	51.8
64.00	53.4	53.1	53.5	55.1	56.7	55.1	56.4	55.1	55.6
66.00	56.1	55.9	57.3	58.4	60.0	58.6	59.7	57.8	58.3
68.00	59.0	58.7	60.0	61.0	61.5	61.3	62.1	60.4	61.0
70.00	61.7	61.4	63.0	63.5	64.8	63.9	64.7	62.8	63.5
72.00	64.5	64.3	65.2	65.6	67.8	66.0	66.8	65.3	66.0
74.00	66.1	65.9	68.2	68.3	70.2	68.7	69.3	67.0	67.7
76.00	68.9	68.8	70.7	70.5	72.4	71.0	71.3	69.5	70.0
78.00	71.0	71.0	72.2	72.1	74.5	72.5	72.9	71.4	71.9
80.00	72.8	72.8	74.5	74.4	76.3	74.6	74.8	73.1	73.6

ENCIRCLED ENERGY

Task 2.2 - Nominal + Mfg. Error -15° Off Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1
10.00	0.5	0.6	0.2	0.5	0.5	0.5	0.3	0.7	0.7
15.00	1.7	1.9	0.9	1.8	1.0	1.9	1.2	2.2	2.1
20.00	3.4	3.6	2.4	3.5	1.9	3.5	2.9	4.2	4.0
25.00	5.4	5.5	5.5	5.9	5.1	5.9	6.3	6.6	6.3
30.00	8.6	8.7	8.8	9.1	9.4	8.9	9.8	10.0	9.7
35.00	13.7	13.7	12.6	13.6	13.9	13.4	13.7	14.8	14.6
40.00	19.5	19.4	18.2	19.9	18.5	19.7	19.6	20.7	20.4
45.00	25.3	25.2	25.5	26.4	25.7	26.3	26.9	26.8	26.6
50.00	32.2	32.1	32.6	33.2	34.0	33.0	34.4	34.5	34.2
55.00	39.5	39.4	40.1	41.0	43.3	40.8	42.6	42.0	41.8
60.00	46.8	46.7	48.0	49.5	50.8	49.3	50.8	49.2	49.3
65.00	54.4	54.2	56.0	57.3	58.1	57.3	58.5	56.2	56.7
70.00	61.7	61.4	63.0	63.5	64.8	63.9	64.7	62.8	63.5
75.00	67.9	67.8	69.1	69.2	71.5	69.7	70.2	68.5	69.1
80.00	72.8	72.8	74.5	74.4	76.3	74.6	74.8	73.1	73.6
85.00	76.8	76.9	78.7	78.6	79.8	78.6	78.8	77.1	77.3
90.00	80.3	80.3	81.3	81.3	82.3	81.3	81.4	80.4	80.5
95.00	82.8	82.9	83.3	83.3	83.9	83.3	83.4	82.9	82.8
100.00	84.5	84.6	84.9	84.9	85.1	84.9	84.8	84.6	84.5
105.00	85.8	85.9	86.1	86.1	86.2	86.1	86.0	85.9	85.7
110.00	86.9	87.0	87.1	87.1	87.2	87.1	87.1	87.0	86.9
115.00	87.9	88.0	88.0	88.0	88.2	88.1	88.1	88.0	88.0
120.00	88.8	88.9	88.9	88.9	89.1	89.0	89.0	88.9	88.9
125.00	89.6	89.6	89.7	89.7	90.0	89.8	89.8	89.6	89.6
130.00	90.3	90.3	90.4	90.5	90.6	90.5	90.4	90.3	90.3
135.00	90.9	90.9	90.9	91.0	91.1	91.0	91.1	91.0	91.0
140.00	91.4	91.4	91.4	91.5	91.5	91.5	91.6	91.5	91.5
145.00	91.8	91.8	91.8	91.9	91.9	91.9	92.0	91.9	91.9
150.00	92.3	92.2	92.3	92.4	92.3	92.3	92.4	92.3	92.3
155.00	92.7	92.7	92.7	92.7	92.7	92.7	92.7	92.7	92.7
160.00	93.1	93.1	93.1	93.1	93.1	93.1	93.0	93.1	93.1
165.00	93.5	93.5	93.6	93.5	93.5	93.5	93.5	93.4	93.4
170.00	93.8	93.8	93.9	93.9	93.9	93.9	93.8	93.8	93.8
175.00	94.2	94.2	94.2	94.2	94.3	94.2	94.2	94.1	94.2
180.00	94.5	94.5	94.5	94.6	94.6	94.6	94.6	94.5	94.5
184.99	94.8	94.8	94.7	94.8	94.8	94.8	94.8	94.9	94.9
189.99	95.1	95.1	95.1	95.1	95.2	95.1	95.2	95.1	95.2
194.99	95.3	95.3	95.4	95.4	95.4	95.4	95.4	95.4	95.4
199.99	95.6	95.7	95.7	95.6	95.7	95.7	95.7	95.7	95.6

FIGURE B22

Wavefront Map-0 Polarization

Task 2.2 - Nominal + Mfg. Error -15° Off Axis

MAP IN UNITS OF 0.01 WAVES

```
                                                  174 166 172 177
                                          210 199 187 176 167 159 165 171 176 182 189 195
                                      220 212 202 192 181 170 161 154 160 166 172 178 185 191 198 204
                                  215 209 202 193 183 173 163 154 148 153 159 166 172 179 186 193 200 207
                              208 206 203 198 191 183 174 164 155 147 141 146 152 159 165 172 179 186 193 200 207 214
                          197 196 194 191 187 181 174 165 156 148 140 134 139 144 151 157 164 171 177 184 191 199 206 213
                          187 185 184 182 178 172 165 158 149 141 133 127 131 137 143 149 155 162 168 175 182 190 197 205
                      179 172 165 176 174 170 165 159 151 143 135 128 121 124 130 135 141 147 153 160 167 174 181 173 183 193
                  189 182 176 169 162 154 163 158 152 145 138 130 123 116 118 123 128 133 139 145 152 158 151 162 172 182 192 201
                  192 186 179 172 165 156 148 138 129 140 132 125 118 110 112 116 121 126 131 120 131 142 152 163 173 182 191 199
              201 194 188 182 174 166 158 148 139 129 119 110 119 112 104 105 109 113 103 113 123 133 144 155 165 174 183 191 198 206
              203 196 190 183 175 167 157 147 137 127 117 107  98  89  98  98  88  97 106 116 126 136 146 157 166 175 183 190 197 204
          205 198 191 183 175 166 156 145 135 124 114 104  95 105 101 101 108 100 109 118 128 138 148 158 167 175 182 189 196 202
              199 191 183 174 164 154 143 132 122 111 122 117 112 108 107 114 122 129 120 129 139 148 157 166 174 181 187 193
              200 191 182 173 162 152 141 130 141 135 129 124 119 114 113 120 127 135 142 149 138 147 155 164 171 178 184 191
                  193 183 172 162 169 162 155 149 142 137 131 126 121 118 125 132 140 148 155 161 166 170 160 167 174 181
                  194 184 192 185 178 171 164 157 151 144 139 133 128 124 130 138 146 154 161 168 173 177 179 181 171 178
                      208 201 194 186 179 173 166 159 153 146 140 135 130 136 144 152 161 169 176 182 186 188 190 191
                          210 202 195 188 181 174 168 161 154 148 142 137 143 151 160 169 178 185 192 196 195 201
                              210 203 196 189 182 175 169 162 156 149 144 150 159 168 178 187 196 203 208 212
                          209 202 195 189 182 175 169 162 156 151 157 166 176 187 197 207 214 220
                              199 193 186 180 174 168 162 156 164 173 184 195 206 216
                                  190 184 179 173 168 162 169 179 190 202
```

SDS Q POLARI AVERAGE AVERAGE QUARTER

1

NONE RMS 0.28 PK-PK 1.33 FRED WAVEFRONT

FIGURE B23

Wavefront Plot-Q Polarization

Task 2.2 - Nominal + Mfg. Error -15° Off Axis

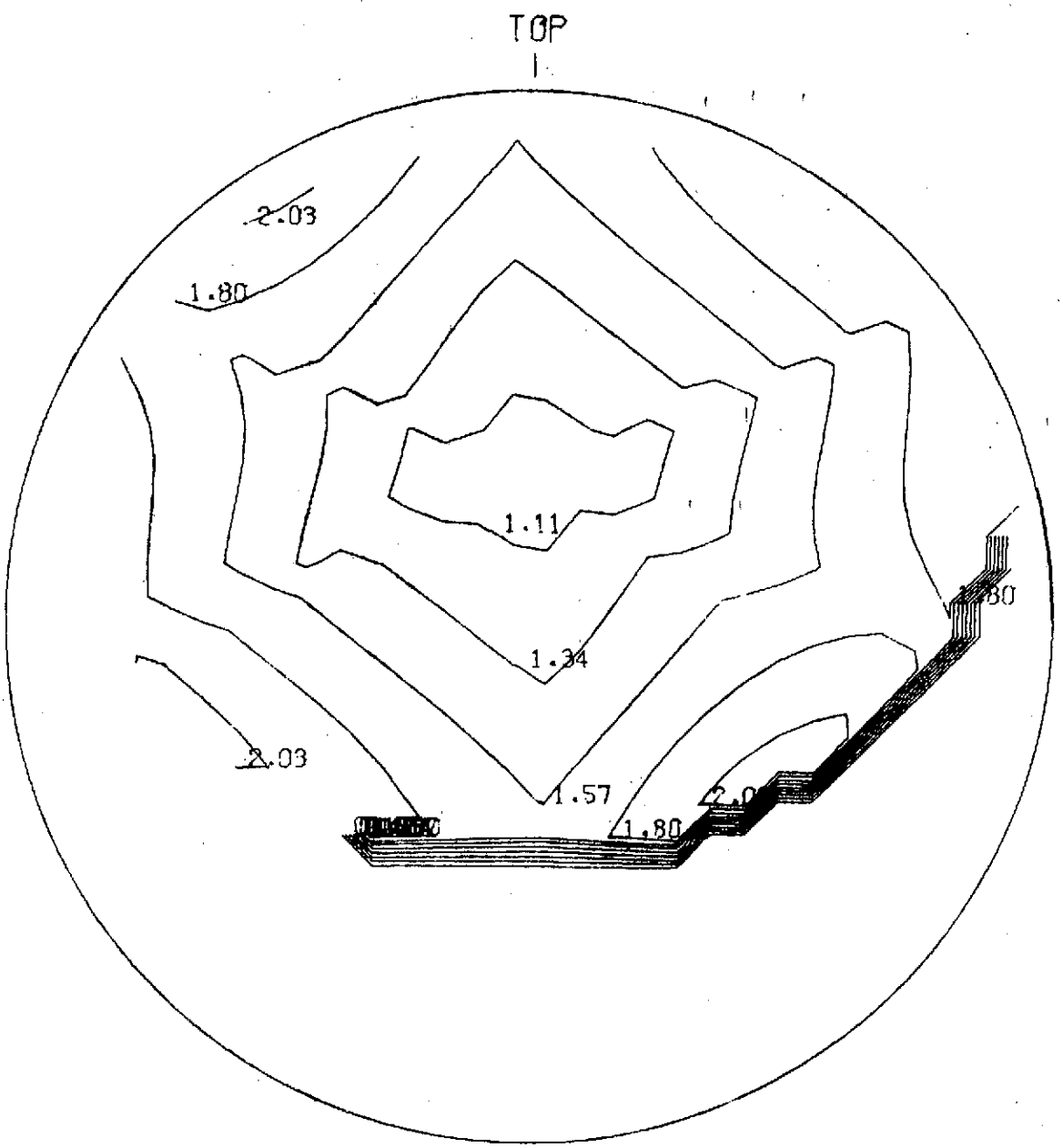


FIGURE B24

Wavefront Map-P Polarization

Task 2.2 - Nominal + Mfg. Error -15° Off Axis

MAP IN UNITS OF 0.01 WAVES

```
                                                143 135  -7  -2
                                        180 168 157 146 136 128 -14  -9  -3   2   8  14
                                    190 182 172 161 150 139 130 123 -20 -14  -8  -2   4  11  17  24
                                184 179 171 162 152 142 132 124 117 -26 -20 -14  -7   0   5  12  19  26
                            178 175 172 167 161 152 143 134 125 117 110 -33 -27 -21 -14  -8  -1   5  12  19  26  34
                        167 165 163 161 156 150 143 135 126 117 109 103 -41 -35 -29 -23 -16  -9  -2   4  11  18  25  33
                        156 155 153 151 147 142 135 127 119 110 103  96 -48 -43 -37 -31 -24 -18 -11  -4   2   9  16  24
                    195 189 182 146 143 139 134 128 121 113 105  97  91 -55 -50 -44 -39 -33 -26 -20 -13  -6   0  40  50  60
                205 199 192 185 178 170 133 128 122 115 107 100  92  85 -62 -57 -52 -46 -41 -35 -28 -21  18  25  39  49  59  68
            208 202 196 189 181 173 164 155 145 109 102  94  87  80 -68 -64 -59 -54 -48 -12  -1   5  15  30  40  49  58  66
        218 211 205 198 191 183 174 165 155 145 135 126  88  81  74 -75 -71 -66 -29 -19  -9   0  11  22  32  41  50  58  65  73
        220 213 206 199 192 183 174 164 154 144 134 124 115 106  67 -82 -44 -35 -26 -16  -6   3  13  24  33  42  50  57  64  71
        221 214 207 199 191 182 172 162 151 141 131 121 112 -65 -69  80  87 -32 -23 -14  -4   5  15  25  34  42  49  56  63  69
            215 207 199 190 180 170 159 149 138 128 -49 -54 -58 -62  86  93 101 108 -12  -3   6  15  24  33  41  48  54  60
            216 208 199 189 179 168 157 146 -30 -36 -41 -46 -51 -56  91  99 106 114 121 128   5  14  22  31  38  45  51  58
                209 199 189 178  -1  -8 -15 -22 -28 -34 -39 -44 -49  97 104 111 119 127 134 140 145 149  27  34  41  48
                211 200  21  14   6   0  -7 -13 -20 -26 -32 -37 -43 102 109 116 125 133 140 147 152 156 158 160  38  45
                    37  30  22  15   8   1  -5 -11 -18 -24 -30 -36 109 115 123 131 140 148 155 160 164 167 169 170
                        38  31  24  17  10   3  -3 -10 -16 -22 -28 116 122 130 138 148 156 164 170 175 178 180
                        39  32  25  18  11   4  -2  -8 -15 -21 123 129 137 147 157 166 175 182 187 191
                        38  31  24  17  11   4  -2  -8 -14 129 136 145 155 166 176 185 193 199
                            28  22  15   9   3  -2  -8 135 142 152 162 174 185 195
                                19  13   8   2  -2 140 148 158 169 181
```

ADD P POLARI AVERAGE AVERAGE QUARTER

1

NONE RMS 0.83 PK-PK 3.04 FRED WAVEFRONT

B35

FIGURE B25

Wavefront Plot-P Polarization

Task 2.2 – Nominal + Mfg. Error -15° Off Axis

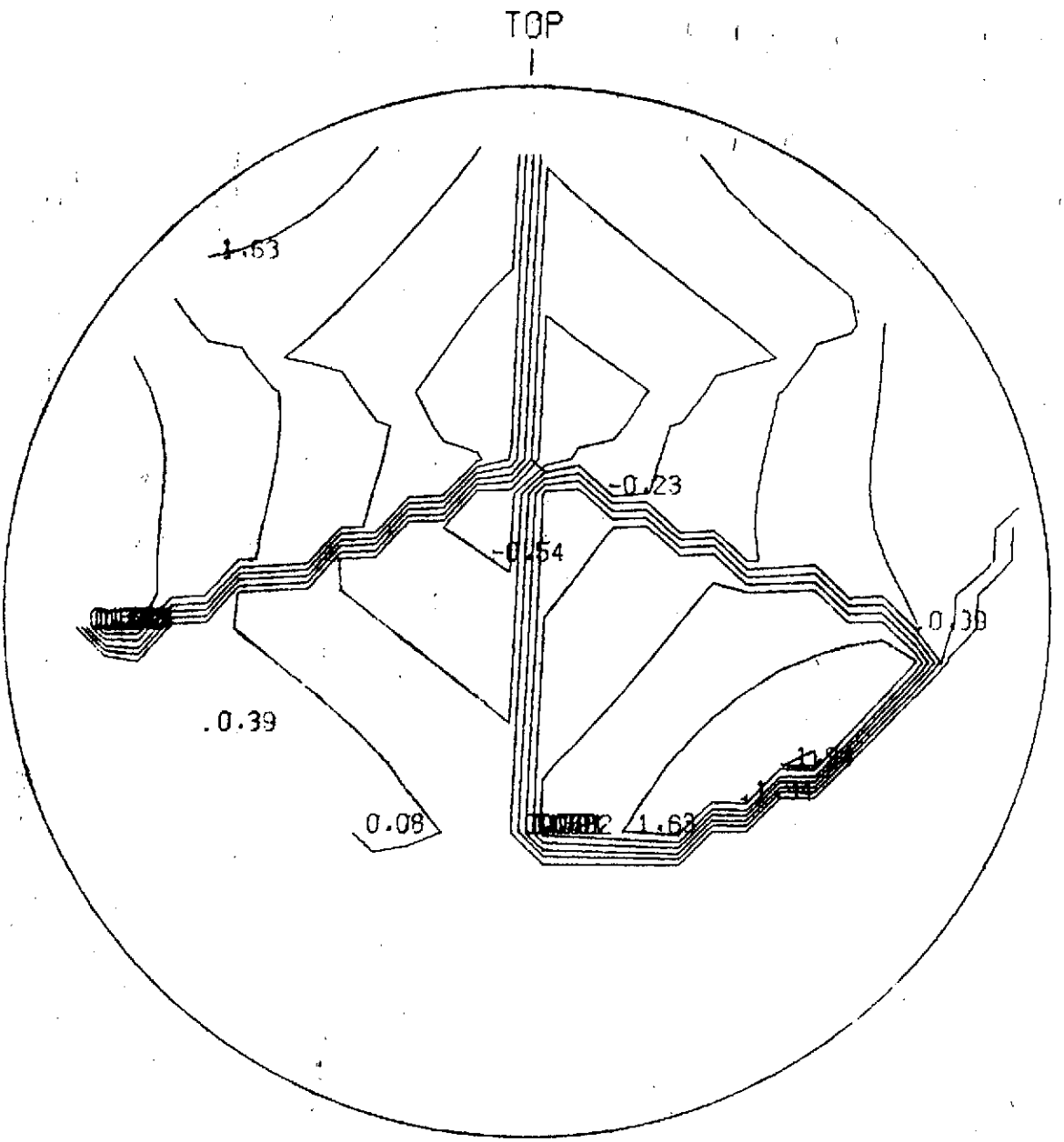


FIGURE 826

Task 2.2 - Nominal + Mfg. Error -15° Off Axis

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0156 = 100
TOTAL ENERGY = 0.1870400D+01
MAP REPRESENTS 0.1737443D+01 OR 92.8915 PERCENT OF TOTAL ENERGY

```
  0  1  1  1  1  1  1  1  1  0  0  0  0  0  0  0  1  1  1  1  2  1  0  0  0  0  0  0  0  1  1  1  1  1  0  0  1  1
  0  1  1  1  1  1  1  1  0  1  1  1  0  0  0  0  0  1  1  0  1  2  1  0  1  0  0  0  1  1  0  1  1  1  1  0  0  0  1
  0  0  0  1  1  1  1  1  1  2  2  1  1  1  1  0  0  0  1  2  0  2  4  3  1  1  1  0  1  1  1  1  1  1  1  0  0  0  0
  0  0  0  0  0  0  0  1  2  2  2  2  2  2  1  0  1  3  3  2  3  5  3  1  0  1  1  1  1  1  1  1  1  0  0  0  0  0  0
  0  0  0  1  1  0  1  1  2  1  2  3  2  0  1  1  4  4  3  5  5  2  1  1  0  1  2  1  2  1  0  0  0  1  0  0  0  0  0
  0  0  1  1  1  1  1  1  2  2  4  3  1  2  2  1  3  3  3  5  4  1  1  2  1  1  2  2  2  1  1  1  0  1  0  0  0  0  0
  0  0  1  1  2  2  3  4  4  3  2  3  5  2  2  4  3  2  4  5  2  1  4  4  2  2  3  3  2  1  1  0  1  1  1  0  0  0  0
  0  0  1  0  1  2  3  3  3  3  4  7  7  4  6  7  4  4  8  9  9  4  6  7  5  3  2  3  2  1  1  0  0  1  0  0  0  0  0
  0  1  1  1  1  1  2  1  2  5  8 12 12 13 15 10  6  6  6 11 16 14 14 13  8  4  2  1  2  1  1  1  1  0  0  0  0  0  0
  1  1  1  1  1  1  2  2  3  7 12 17 20 24 21 11  8 10  8 11 19 24 26 21 11  6  3  1  1  1  1  1  1  1  1  0  0  0  0
  2  1  0  1  1  2  5  5  4  9 18 23 27 31 22 11 11 12 13 18 21 27 31 27 17  6  2  1  1  2  1  1  1  1  1  0  0  0  0
  2  2  1  1  2  5  8  8 10 20 29 31 38 41 28 18 14  8 15 26 30 36 34 32 28 12  4  3  3  4  3  2  2  2  2  0  0  0  0
  2  2  2  3  4  7  9 12 21 34 37 38 54 57 41 31 19  6 12 24 39 58 52 41 39 24 11  7  4  5  6  5  3  2  2  0  0  0  0
  1  1  2  3  4  5  6 13 25 34 33 43 66 62 45 39 22  8 13 23 42 72 69 47 40 29 15  8  3  3  4  4  2  1  1  0  0  0  0
  1  1  1  2  2  2  3  9 18 25 28 49 66 47 40 38 15  6 16 34 46 62 67 47 33 24 13  6  1  1  2  2  1  0  1  0  0  0  0
  1  1  0  1  2  2  4  6 11 20 31 52 54 31 41 36  5  1 12 41 52 43 52 49 32 21 12  5  1  1  1  1  1  1  1  0  0  0  0
  1  0  0  1  2  3  3  4  8 18 27 37 30 20 44 32  5 11  5 32 48 25 33 42 30 22 13  5  1  1  1  1  1  0  0  0  0  0  0
  0  0  1  1  1  1  1  4  8 13 13 14 11 15 40 24  7 20  6 23 39 12 14 20 16 18 14  7  2  0  1  1  1  0  0  0  0  0  0
  0  1  1  2  1  0  2  7  8  8  6 10 20 29 46 32  9 11 10 33 40 20 18 10  4 11 12 10  5  2  1  1  1  1  0  0  0  0  0
  0  1  1  2  1  1  3  7  5  4  9 26 55 63 63 52 18  0 16 49 52 49 52 25  5  4  6  9  8  4  1  1  1  1  1  0  0  0  0
  0  1  1  1  0  1  2  4  2  5 21 48 86 90 66 50 24  5 23 49 56 76 83 46 16  5  1  4  5  3  2  1  1  1  0  0  0  0  0
  1  1  1  1  1  2  2  3  5 18 45 72100 95 54 26 14 10 21 35 53 84 89 60 39 22  7  3  3  3  2  2  2  1  0  0  0  0  0
  1  1  1  2  2  2  3  5 11 29 64 86 91 79 47 19  7  7 15 27 48 73 79 72 64 40 17  7  3  2  2  2  2  1  0  0  0  0  0
  1  1  1  1  1  2  2  4  9 24 53 70 61 48 40 29 16 10 15 26 41 52 60 66 59 36 18 11  6  2  1  1  1  1  0  0  0  0  0
  0  1  1  1  1  1  1  2  5 10 24 36 33 23 24 27 21 15 15 22 28 32 38 40 30 16 12 11  6  2  1  1  0  1  0  0  0  0  0
  0  1  1  1  1  1  1  1  1  3  6 14 20 17 13 14 15 13 10 13 17 20 21 15  8  5  5  6  4  2  1  0  0  1  0  0  0  0  0
  0  0  0  0  1  1  2  1  0  2  4  8 14 16 13 10  9  7  5  8 11 13 12  6  3  2  1  1  1  0  1  0  0  0  0  0  0  0  0
  0  0  0  0  1  1  2  3  3  3  4  6  6  9 12 11  6  3  4  7  7  6  6  4  3  2  1  2  1  0  0  0  0  0  0  0  0  0  0
  0  0  0  0  1  1  2  5  7  5  4  4  3  2  8 10  5  2  4  5  3  2  3  3  4  5  6  5  3  1  1  0  0  0  0  0  0  0  0
  0  0  0  0  1  1  1  3  6  5  2  2  2  1  3  7  5  3  3  3  1  1  1  2  4  6  6  4  2  2  1  0  0  0  0  0  0  0  0
  0  0  0  0  0  1  1  1  2  2  1  0  1  0  2  5  5  3  2  2  1  1  1  2  4  4  3  2  1  2  2  1  0  0  0  0  0  0  0
  0  0  0  1  1  0  0  0  0  0  0  0  0  0  1  2  3  3  1  2  2  1  0  1  2  2  2  1  0  0  1  1  1  1  0  0  0  0  0
  0  0  0  1  1  1  1  0  0  0  0  0  0  1  3  3  1  1  2  2  1  0  1  1  1  1  1  0  0  1  1  1  1  0  0  0  0  0  0
  0  0  0  1  1  2  2  1  1  1  0  0  1  1  2  2  1  0  1  1  1  1  0  0  1  1  1  1  2  2  1  1  0  0  0  0  0  0  0
  0  0  0  0  1  2  2  1  0  0  0  1  2  1  0  1  1  1  1  1  1  1  0  0  0  0  1  2  3  2  1  1  0  0  0  0  0  0  0
 10
 10
```

ID
ID
NONE RMS 2.21 PK-PK 10.16 FREQ WAVEFRONT

FIGURE B27

Intensity Distriubtion - Central 129 Microradians
Task 2.2 - Nominal + Mfg. Error -15° Off Axis

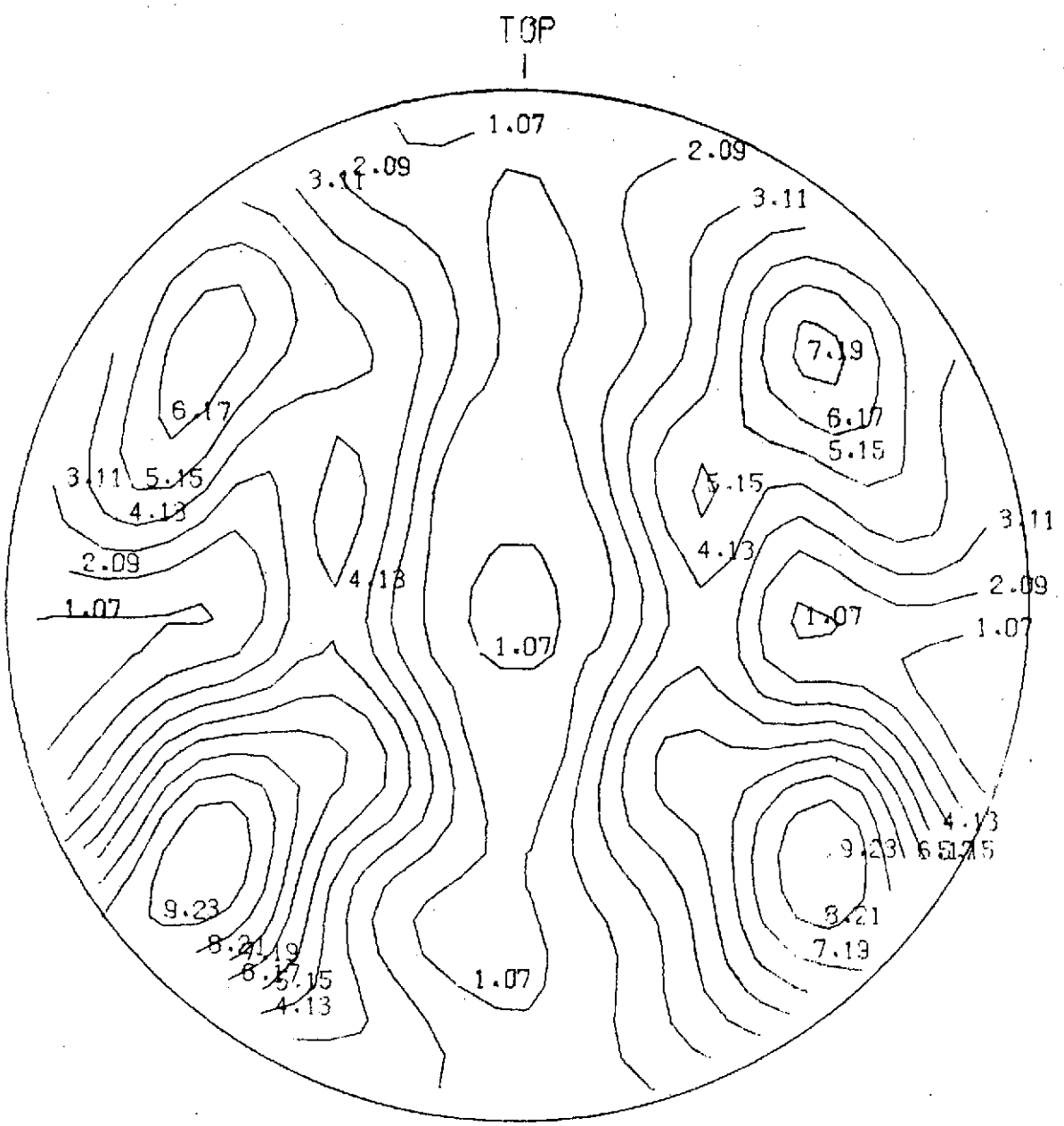


FIGURE B28

Encircled Energy

Vs

Field Angle

Task 2.2 - Nominal

+ Mfg. Error -15° Off Axis

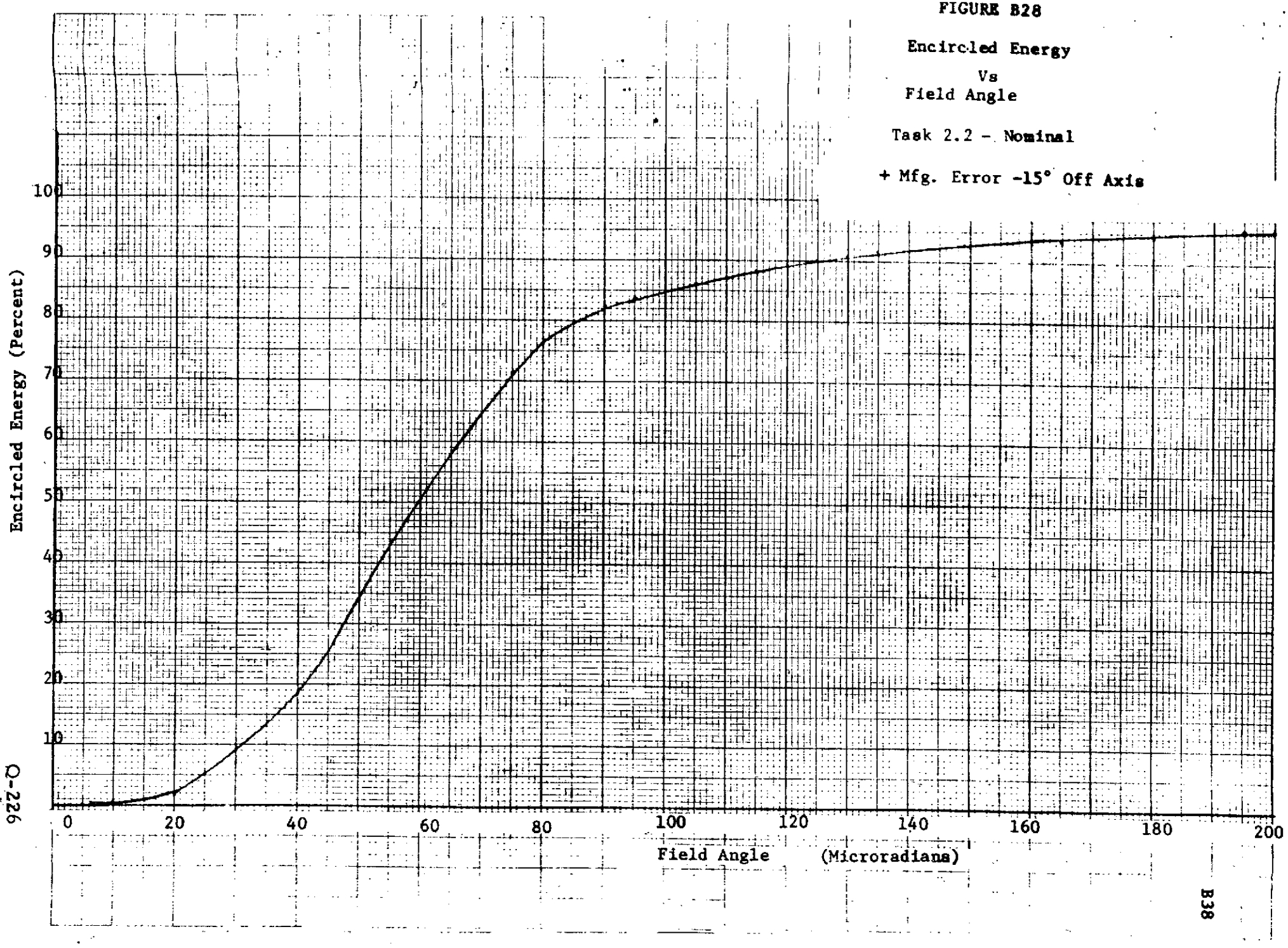


TABLE B10

ENCIRCLED ENERGY

Task 2.3B - Nominal + Mfg. Error + First Temperature On Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.00	0.1	0.1	0.0	0.1	0.0	0.1	0.0	0.0	0.1
6.00	0.1	0.1	0.1	0.2	0.3	0.2	0.1	0.0	0.1
8.00	0.3	0.2	0.2	0.4	0.3	0.3	0.2	0.2	0.4
10.00	0.5	0.3	0.2	0.5	0.5	0.5	0.3	0.3	0.5
12.00	0.9	0.7	0.5	0.7	0.5	0.7	0.6	0.7	0.8
14.00	0.9	0.7	0.8	0.9	0.8	0.9	0.9	0.7	0.8
16.00	1.5	1.3	1.1	1.2	1.0	1.2	1.2	1.2	1.3
18.00	1.8	1.5	1.5	1.4	1.6	1.5	1.5	1.5	1.6
20.00	2.3	2.2	2.2	1.9	1.6	1.9	2.1	2.2	2.2
22.00	2.6	2.5	2.8	2.3	2.3	2.3	2.6	2.5	2.5
24.00	3.6	3.6	3.4	2.8	2.7	2.9	3.3	3.7	3.6
26.00	4.2	4.1	4.2	3.5	3.5	3.5	4.0	4.3	4.2
28.00	5.8	5.9	5.6	4.6	3.8	4.6	5.6	6.1	5.9
30.00	6.7	6.9	6.5	5.6	5.1	5.6	6.6	7.2	7.0
32.00	8.9	9.3	8.0	6.7	5.8	6.7	8.2	9.6	9.2
34.00	9.4	9.9	9.5	8.6	7.7	8.5	10.0	10.2	9.8
36.00	11.8	12.6	11.3	10.0	9.3	9.9	12.1	13.1	12.3
38.00	13.1	13.9	13.1	12.2	12.4	12.2	14.1	14.6	13.8
40.00	15.6	16.6	15.4	14.2	13.9	14.1	16.6	17.6	16.4
42.00	16.8	17.8	18.2	17.4	18.1	17.3	19.3	18.9	17.7
44.00	20.0	21.0	20.5	19.4	20.1	19.2	21.8	22.5	21.2
46.00	22.4	23.3	23.5	23.5	24.6	23.3	24.9	25.0	23.7
48.00	25.9	26.8	27.4	27.0	26.0	26.7	28.7	28.7	27.3
50.00	29.0	29.7	29.7	30.1	30.7	29.9	31.3	31.7	30.4
52.00	33.0	33.7	33.5	33.6	33.3	33.4	35.0	35.7	34.4
54.00	35.2	35.9	36.4	37.5	38.1	37.2	38.3	37.9	36.6
56.00	39.4	40.0	40.9	41.4	41.2	41.1	42.7	41.8	40.7
58.00	42.6	43.1	43.7	44.4	46.3	44.2	45.6	44.9	43.8
60.00	46.0	46.6	47.6	48.2	50.0	48.0	49.4	48.2	47.4
62.00	48.6	49.0	51.0	52.3	54.2	52.1	52.7	50.4	49.7
64.00	52.9	53.2	54.0	55.1	57.5	54.9	55.5	54.4	54.1
66.00	55.5	55.8	57.6	59.3	61.4	59.2	58.7	56.8	56.6
68.00	59.4	59.4	60.7	61.8	63.3	61.8	61.5	60.3	60.3
70.00	61.7	61.7	63.6	65.0	66.5	65.0	64.1	62.3	62.5
72.00	65.2	65.0	66.1	67.3	69.1	67.3	66.5	65.5	65.8
74.00	67.1	66.7	68.9	69.8	71.4	69.9	69.0	67.1	67.5
76.00	70.1	69.5	71.4	71.8	73.1	71.9	71.4	69.8	70.4
78.00	72.0	71.4	72.9	73.4	75.0	73.4	72.9	71.5	72.1
80.00	74.1	73.3	74.9	75.1	76.4	75.2	75.0	73.4	74.2

TABLE B11

ENCIRCLED ENERGY

Task 2.3B - Nominal + Mfg. Error + First Temperature On Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.0	0.1
10.00	0.5	0.3	0.2	0.5	0.5	0.5	0.3	0.3	0.5
15.00	1.3	1.1	1.0	1.1	1.0	1.1	1.1	1.0	1.1
20.00	2.3	2.2	2.2	1.9	1.6	1.9	2.1	2.2	2.2
25.00	4.0	4.0	4.0	3.3	3.0	3.3	3.8	4.1	4.0
30.00	6.7	6.9	6.5	5.6	5.1	5.6	6.6	7.2	7.0
35.00	10.8	11.4	10.3	9.0	8.8	8.9	10.9	11.9	11.3
40.00	15.6	16.6	15.4	14.2	13.9	14.1	16.6	17.6	16.4
45.00	21.3	22.3	22.1	22.1	22.8	21.9	23.5	23.8	22.5
50.00	29.0	29.7	29.7	30.1	30.7	29.9	31.3	31.7	30.4
55.00	38.0	38.5	38.9	39.3	40.4	39.1	40.7	40.4	39.3
60.00	46.0	46.6	47.6	48.2	50.0	48.0	49.4	48.2	47.4
65.00	54.1	54.4	56.3	57.6	59.9	57.5	57.5	55.5	55.2
70.00	61.7	61.7	63.6	65.0	66.5	65.0	64.1	62.3	62.5
75.00	68.8	68.4	70.2	70.9	72.3	70.9	70.3	68.6	69.1
80.00	74.1	73.3	74.9	75.1	76.4	75.2	75.0	73.4	74.2
85.00	77.8	76.9	78.5	78.8	79.7	78.8	78.7	77.0	78.0
90.00	80.8	79.9	81.0	81.4	81.9	81.4	81.2	80.1	81.0
95.00	83.2	82.6	83.1	83.4	83.7	83.4	83.2	82.7	83.3
100.00	84.9	84.5	84.9	85.1	85.3	85.1	84.9	84.6	84.9
105.00	86.1	86.1	86.4	86.5	86.7	86.6	86.4	86.1	86.3
110.00	87.3	87.5	87.6	87.7	88.0	87.8	87.7	87.6	87.5
115.00	88.5	88.8	88.7	88.8	89.1	88.8	88.8	88.8	88.6
120.00	89.5	89.8	89.8	89.7	90.0	89.7	89.8	89.7	89.5
125.00	90.2	90.5	90.6	90.5	90.7	90.5	90.6	90.5	90.3
130.00	91.0	91.2	91.3	91.2	91.3	91.2	91.2	91.2	91.0
135.00	91.8	91.7	91.8	91.8	91.9	91.7	91.8	91.7	91.8
140.00	92.3	92.2	92.3	92.4	92.3	92.3	92.3	92.2	92.2
145.00	92.7	92.8	92.8	92.8	92.8	92.8	92.7	92.7	92.7
150.00	93.1	93.2	93.2	93.2	93.3	93.2	93.2	93.2	93.1
155.00	93.5	93.5	93.6	93.5	93.7	93.5	93.6	93.6	93.5
160.00	93.9	93.9	93.9	93.9	94.0	93.9	93.9	93.9	93.9
165.00	94.2	94.2	94.3	94.3	94.2	94.2	94.2	94.2	94.2
170.00	94.5	94.5	94.6	94.6	94.5	94.5	94.5	94.5	94.5
175.00	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8
180.00	95.1	95.1	95.1	95.1	95.2	95.1	95.1	95.1	95.1
184.99	95.4	95.4	95.4	95.4	95.4	95.4	95.4	95.4	95.4
189.99	95.6	95.6	95.6	95.7	95.7	95.7	95.7	95.7	95.7
194.99	95.9	95.9	95.9	95.9	96.0	95.9	95.9	95.9	95.9
199.99	96.2	96.1	96.1	96.2	96.2	96.2	96.2	96.2	96.2

FIGURE B29

Wavefront Map-0 Polarization

Task 2.3B - Nominal + Mfg. Error + First Temperature On Axis

MAP IN UNITS OF 0.01 WAVES

198 191 184 179 173 186 190 192 194 198

215 207 198 190 183 177 171 166 182 186 188 190 194 202 212 221

213 205 197 189 182 176 171 165 159 174 178 181 183 188 196 205 213 218

209 202 195 187 179 173 169 165 160 154 162 168 171 175 181 188 195 201 205 207

201 197 191 183 176 169 164 161 159 155 149 149 156 161 166 172 179 185 188 191 193 196

190 189 186 179 171 163 158 155 154 152 149 143 137 144 151 158 164 170 175 178 180 182 185 188

179 179 178 174 167 158 151 147 146 147 145 142 136 127 134 142 150 157 163 167 169 170 173 176 180 185

238 171 170 167 162 154 146 140 138 138 139 138 134 128 118 126 133 142 149 155 159 161 162 164 168 172 177 258

239 233 227 158 152 143 134 129 128 130 132 130 126 120 111 117 124 132 139 144 148 152 154 157 160 239 253 258

242 235 228 220 143 133 124 119 118 121 123 122 117 111 103 108 113 119 125 130 136 141 145 149 227 239 250 259

254 245 237 228 219 210 201 116 110 109 111 113 112 108 101 95 99 102 105 110 116 123 130 202 214 227 239 251 261 267

259 249 238 227 216 207 200 191 182 100 100 101 101 97 90 86 89 91 93 97 103 184 193 203 214 226 239 252 263 271

264 252 239 226 214 206 199 192 183 175 169 89 89 85 81 77 79 80 81 172 180 188 196 205 215 225 237 250 263 273

268 256 241 227 214 206 200 194 186 178 172 167 78 75 72 66 69 70 166 175 183 191 199 207 214 223 234 248 262 274

272 259 244 229 217 208 203 196 189 181 174 168 159 148 64 55 143 156 167 176 184 191 199 205 212 220 232 246 261 274

274 261 246 232 220 212 205 199 191 184 176 167 156 143 55 64 148 159 168 174 181 189 196 203 208 217 229 244 259 272

274 262 248 234 223 214 207 199 191 183 175 166 70 69 66 72 75 78 167 172 178 186 194 200 206 214 227 241 256 268

273 263 253 237 225 215 205 196 188 180 172 81 80 79 77 81 85 89 89 169 175 183 192 199 206 214 226 239 252 264

271 263 252 239 226 214 203 193 184 103 97 93 91 89 86 90 97 101 101 100 100 182 191 200 207 216 227 238 249 259

267 261 251 239 227 214 202 130 123 116 110 105 102 99 95 101 108 112 113 111 109 110 116 201 210 219 228 237 245 254

259 250 239 227 149 145 141 136 130 125 119 113 108 103 111 117 122 123 121 118 119 124 133 143 220 228 235 242

258 250 239 160 157 154 152 148 144 139 132 124 117 111 120 126 130 132 130 128 129 134 143 152 158 227 233 239

258 177 172 168 164 162 161 159 155 149 142 133 126 118 128 134 138 139 138 138 140 146 154 162 167 170 171 238

185 180 176 173 170 169 167 163 157 150 142 134 127 136 142 145 147 146 147 151 158 167 174 178 179 179

188 185 182 180 178 175 170 164 158 151 144 137 143 149 152 154 155 158 163 171 179 186 189 190

186 193 191 188 185 179 172 166 161 156 149 149 155 159 161 164 169 176 183 191 197 201

207 205 201 195 188 181 175 171 168 162 154 160 165 169 173 179 187 195 202 209

218 213 205 196 188 183 181 178 174 159 165 171 176 182 189 197 205 213

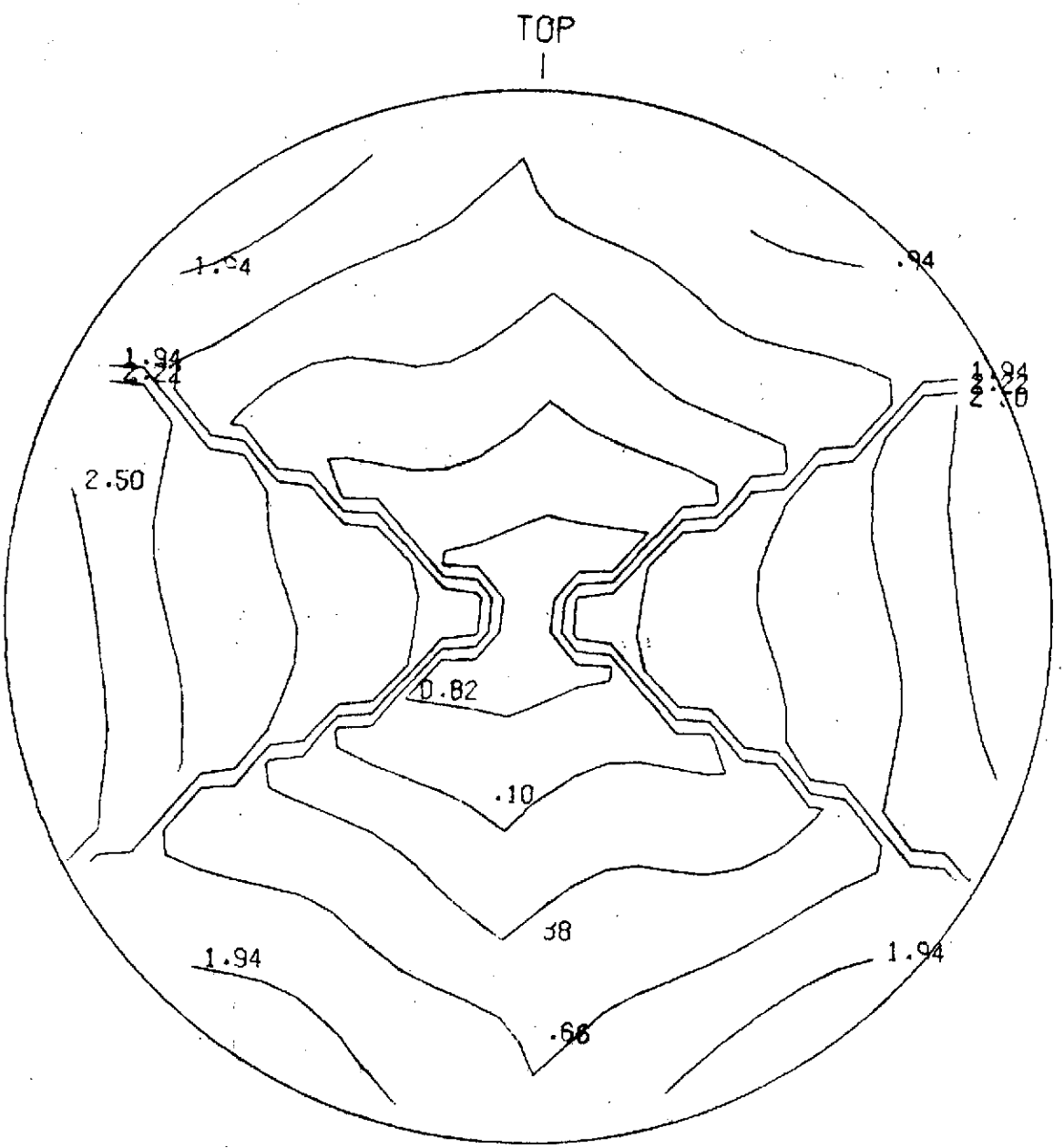
221 212 202 194 190 188 186 182 166 171 177 183 190 198 207 215

198 194 192 190 186 173 179 184 191 198

FIGURE B30

Wavefront Plot-Q Polarization

Task 2.3B - Nominal + Mfg. Error + First Temperature On Axis



Wavefront Map-P Polarization

Task 3.38 - Nominal + Mfg. Error + First Temprature On Axis

843

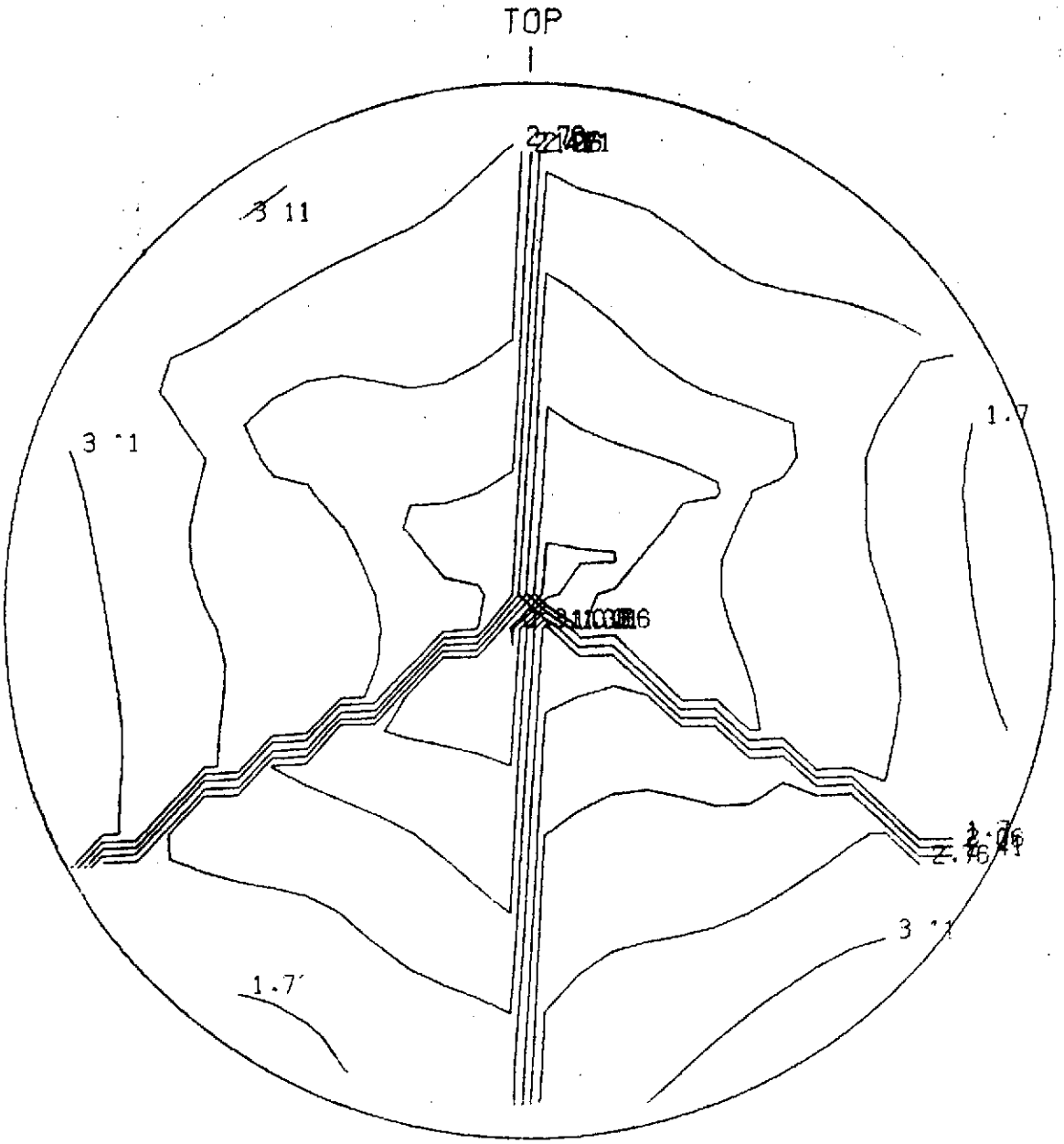
MAP IN UNITS OF 0.01 WAVES

```
                                  307 299 293 287 282 148 148 150 152 157
                              324 315 307 298 292 285 280 274 140 144 146 148 153 160 170 179
                            321 314 305 298 290 285 279 274 268 132 137 139 142 147 155 163 171 177
                          317 311 303 295 288 282 277 273 268 263 120 126 130 133 139 146 154 159 163 166
                        309 306 300 292 284 277 273 270 267 263 257 107 114 119 124 130 137 143 147 150 152 154
                      299 298 294 287 279 272 266 264 262 261 257 251  96 103 109 116 122 129 134 136 138 140 143 147
                    288 288 287 282 275 267 260 256 255 255 254 250 244  85  93 101 109 116 122 125 127 129 131 134 139 143
                  304 279 278 276 271 263 254 248 246 247 248 247 243 237  77  84  92 100 108 114 117 119 121 123 126 131 136 173
                  305 299 293 267 263 251 243 237 236 238 243 239 235 228  69  75  83  90  97 103 107 110 112 115 118 155 165 174
                  308 301 294 286 252 242 233 227 227 229 231 230 226 219  62  67  72  77  83  89  95  99 104 107 143 155 166 174
              320 311 303 294 285 276 267 224 218 218 219 221 220 216 209  54  57  60  64  69  75  82  89 118 130 143 155 167 177 183
              325 315 334 293 282 273 266 257 248 208 209 210 209 205 199  45  47  49  51  55  62 100 109 119 130 142 155 162 179 187
              330 318 305 292 280 272 265 258 249 241 235 198 197 194 189  35  37  38  40  88  96 104 112 121 131 141 153 166 179 189
              334 322 307 293 280 272 266 260 252 244 238 233 186 184 181  25  27  28  82  91  99 107 115 123 130 139 150 164 178 190
              338 325 310 295 283 274 269 262 255 247 240 234 225 214 172  13  59  72  83  92  99 107 115 121 128 136 148 162 177 190
              340 327 312 298 286 278 271 265 257 249 242 233 222 209  25 184  64  75  84  90  97 105 112 119 124 133 145 163 175 188
              340 328 314 300 289 280 273 265 257 249 241 232  40  39  36 192 196 198  83  88  94 102 110 116 122 130 143 157 172 184
              339 329 316 303 291 281 271 262 254 246 238  51  50  49  47 201 206 209 209  85  91  99 108 115 122 130 142 155 168 180
              337 329 317 305 292 283 269 259 250  73  67  63  61  59  56 211 217 221 222 220 220  98 107 116 123 132 143 154 165 175
              333 327 317 305 293 280 268 100  93  86  80  75  72  69  65 221 228 232 233 231 229 230 236 117 126 135 144 153 161 170
                324 316 305 293 119 115 111 106 101  95  89  83  78  73 231 238 242 243 241 239 239 245 254 264 136 144 151 158
              324 315 305 130 127 124 122 118 114 109 102  94  87  81 240 246 251 252 250 248 249 255 263 272 278 143 149 155
              323 147 142 138 135 132 131 129 125 119 112 104  96  88 249 254 258 259 259 258 260 266 274 282 288 293 291 154
            155 150 146 143 140 139 137 133 127 120 112 105  97 256 262 266 267 267 268 271 278 287 294 298 299 299
          158 155 152 150 148 145 140 134 128 121 114 107 263 269 273 274 276 278 284 291 299 306 310 310
        166 163 161 159 155 149 142 136 131 126 119 269 275 279 282 285 289 296 304 311 318 321
      177 175 171 165 158 151 145 141 138 132 274 280 285 289 294 300 307 315 322 329
    188 183 175 166 158 153 151 148 144 279 285 291 296 302 309 317 325 333
  191 182 172 164 160 158 156 152 286 291 297 304 310 318 327 335
                168 164 162 160 156 294 299 304 311 319
```

FIGURE B32

Wavefront Plot-P Polarization

Task 2.3B - Nominal + Mfg. Error + First Temperature On Axis



REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

FIGURE B33

Task 2.3B - Nominal + Mfg. Error + First Temperature On Axis

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0167 = 100
TOTAL ENERGY = 0.2461000D+01
MAP REPRESENTS 0.2307952D+01 OR 93.7811 PERCENT OF TOTAL ENERGY

```
  1  1  1  1  0  0  1  2  1  0  1  1  2  2  1  1  1  1  0  0  1  2  1  1  1  1  1  1  0  1  1  1  1  1
  1  1  1  1  0  0  1  1  1  1  1  0  1  2  3  3  1  0  0  2  3  4  3  1  1  1  1  2  1  0  0  1  1  1  1
  1  1  1  0  0  0  1  1  1  1  1  0  0  1  1  2  4  2  2  2  2  2  3  4  2  1  2  1  1  1  1  1  0  1  1  0
  0  1  1  0  0  1  1  1  1  2  2  1  0  0  1  2  3  4  4  1  0  2  2  2  1  2  1  1  1  1  1  1  1  0  0  0
  0  0  0  1  1  0  1  1  2  3  4  3  3  2  2  4  5  5  4  2  2  2  2  2  2  1  1  1  1  2  1  1  0  0  0  0
  0  0  0  1  1  0  1  1  2  5  5  5  5  2  4  8 11 13  9  6  4  2  2  2  2  2  1  0  2  1  1  1  0  0  0  0
  0  0  1  1  2  2  2  2  6  7  6  7  6  3  4  5 14 21 12  6  7  4  3  3  1  1  1  1  2  1  1  1  1  1  0  0
  1  0  1  1  2  2  3  6  8  7  9 11  7  8  9  7 13 18 13 12 16 10  5  6  3  0  1  2  1  1  1  1  1  0  0  1
  1  0  1  1  1  2  3  5  6  9 11  8 10 16 18 20 21 21 27 32 37 32 16  8  4  1  3  2  1  1  0  0  1  1  1  1
  0  1  1  1  1  3  3  2  3  7  7 13 26 33 39 46 43 46 54 54 53 50 35 19  8  5  5  2  2  2  1  0  1  2  2  1
  1  0  0  2  3  4  3  2  1  1  7 24 31 40 68 67 51 60 69 76 75 59 43 29 17 10  5  2  3  2  1  1  1  1  1  1
  1  1  2  3  3  5  6  5  3  3 13 28 36 59 84 64 57 76 70 77 98 86 57 38 26 14  7  5  3  1  1  2  3  2  1  1
  1  2  3  1  2  6  7  6  4  5 12 23 45 72 74 62 81100 75 60 82 82 50 37 27 11  9  8  4  1  1  2  2  2  1  1
  1  1  1  1  3  5  4  5  5  6 13 17 29 44 51 57 55 51 49 43 53 51 33 41 31 14 14  6  6  4  4  4  1  1  1  1
  1  0  1  2  3  3  1  6  9  8 15 18 18 22 34 38 18 13 27 25 24 30 36 48 35 26 25  7  6  8  6  5  1  2  1  1
  0  0  1  2  3  4  3  6 11 17 22 18 17 11 19 23  7  7 16 18  7 18 39 37 30 30 28 12  8  7  6  6  3  2  1  1
  1  1  1  4  5  6  5  7 10 28 35 19 27 18 18 29 15  5  4 19 19 44 55 31 31 28 19 15  9  5  6  7  5  3  1  1
  1  2  2  5  6  6  6 10 11 27 40 30 52 41 16 23 20 22 17 18 19 52 59 29 39 27 11 10  6  6  5  5  3  2  1  1
  1  3  3  6  5  6  6 13 19 28 49 48 53 35  5  7  2  6 18 20  9 19 25 29 48 29 11  5  2  6  4  3  1  1  1  1
  1  2  2  5  4  5  6 14 30 29 40 38 23 14  5 15 18  9 14 17  8  5  3 15 30 21 16  8  1  2  1  2  1  0  0  1
  0  1  2  5  3  4  8 11 26 17 15 23 21 36 35 27 26 17 18 28 32 26 12  6  5  4 12  9  3  2  1  2  1  1  0  1
  0  1  2  5  2  3  7  5  8  3 14 41 55 78 80 59 49 51 60 67 65 52 35 26 13  1  2  4  4  6  3  2  1  1  1  1
  1  2  1  1  1  1  3  3  3  7 28 58 79 93 88 75 81 99 96 80 74 66 48 31 17  6  3  1  3  5  3  1  1  1  1  1
  1  3  3  1  1  1  2  5 11 21 34 52 77 98100 85 75 77 76 84 92 74 46 23 11  8  7  4  1  1  2  3  3  1  1  1
  1  2  2  1  1  2  4  5 10 16 21 31 51 79 98 93 75 60 60 79 81 56 33 15  4  3  5  4  2  2  2  2  1  0  1  1
  1  1  0  0  0  3  5  5  5  4  5 15 31 47 55 54 52 46 41 41 38 31 23 12  6  6  6  5  5  4  2  0  0  0  1  1
  1  1  1  1  1  2  3  3  3  1  2  9 18 27 30 28 26 21 21 21 19 17 13 11 12 11  9  8  7  5  2  1  1  0  1  1
  0  0  1  1  1  1  1  1  2  2  4  6  6 10 16 20 20 18 17 15 11  7  7  9 10  9  9  8  5  4  2  1  0  0  1  1
  0  1  0  1  1  1  1  1  2  3  4  3  3  5  7 14 21 15  6  4  3  6  8  8  7  5  2  1  1  2  1  0  0  0  1  1
  0  0  0  1  1  1  2  1  3  1  2  2  2  1  3  4  8 13 11  6  2  1  4  5  5  4  1  0  0  1  1  1  1  0  0  0
  0  0  0  1  2  2  2  2  1  1  1  1  1  2  3  4  5  5  5  4  2  2  2  2  2  2  1  1  1  1  1  1  1  1  1  1
  0  1  1  1  1  1  2  2  2  1  1  1  2  3  3  3  4  4  3  2  1  1  1  1  1  2  1  1  1  1  1  1  1  1  1  1
  0  1  1  1  0  0  1  2  2  2  1  2  3  2  1  2  2  2  3  3  2  1  1  0  1  1  1  1  1  1  0  0  1  1  1  1
  1  1  1  1  1  1  1  1  1  2  1  1  2  2  2  2  1  0  2  4  3  1  0  0  1  1  1  1  1  0  0  0  1  2  1  1
  1  1  2  2  1  1  1  1  3  1  1  1  1  2  2  1  1  1  1  1  2  2  1  0  1  1  1  1  1  1  0  1  1  1  1  1
ID
ID
```

FIGURE B34

Intensity Distriubtion - Central 129 Microradians

Task 2.3B - Nominal + Mfg. Error + First Temperature On Axis

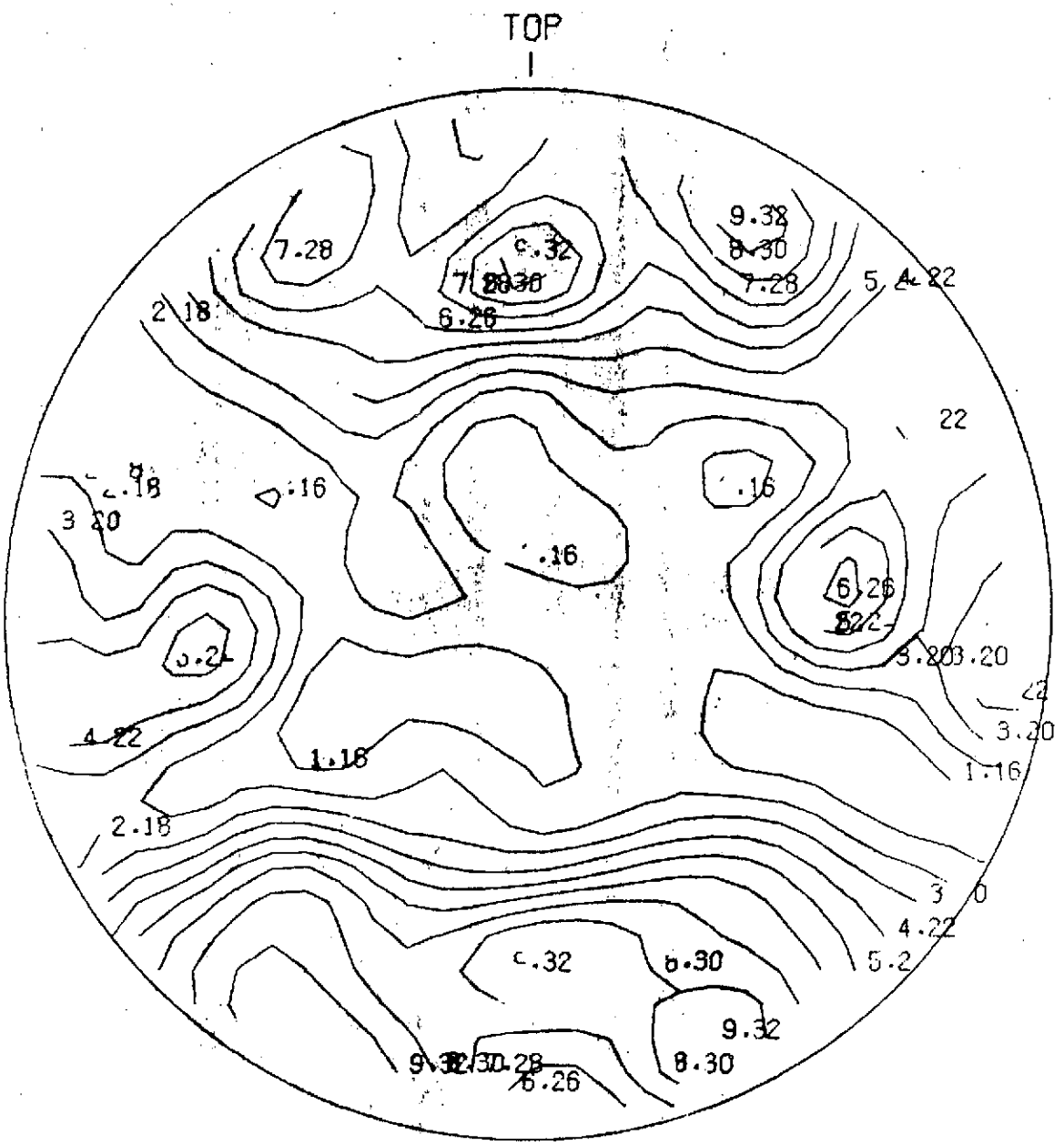


FIGURE B35

Encircled Energy

Vs

Field Angle

Task 2.3B - Nominal

+ Mfg. Error + First Temperature

On Axis

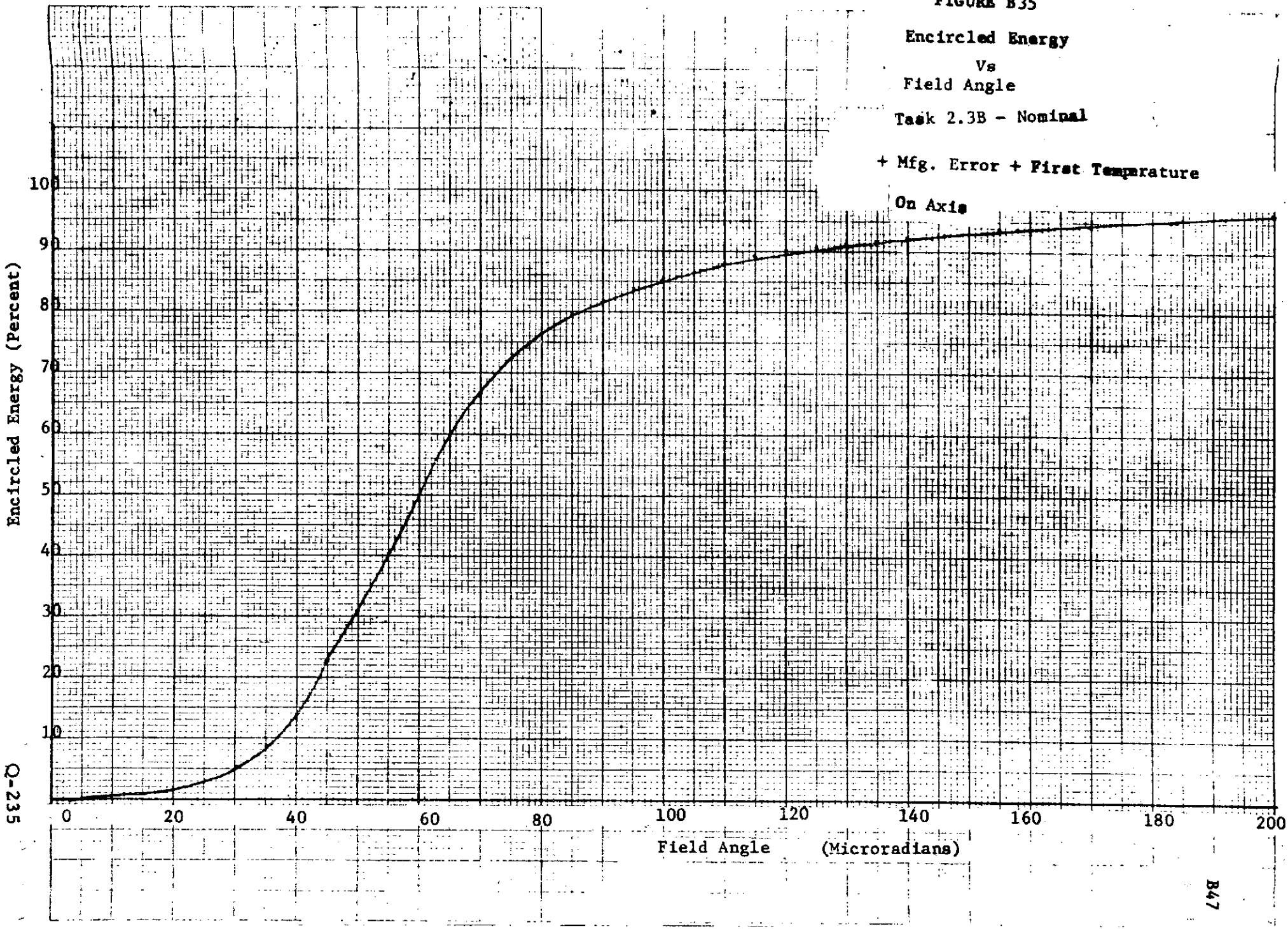


TABLE B12

ENCIRCLED ENERGY

Task 2.3B - Nominal + Mfg. Error + First Temperature -15° Off Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.00	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1
6.00	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1
8.00	0.3	0.3	0.2	0.3	0.2	0.3	0.2	0.4	0.4
10.00	0.4	0.5	0.2	0.5	0.4	0.4	0.3	0.5	0.5
12.00	1.0	1.1	0.4	0.9	0.4	0.8	0.4	1.3	1.2
14.00	1.0	1.1	0.7	1.3	0.6	1.3	0.9	1.3	1.2
16.00	1.8	1.9	0.9	1.8	0.8	1.8	1.1	2.2	2.1
18.00	2.2	2.3	1.5	2.3	1.6	2.3	1.8	2.7	2.5
20.00	2.9	3.1	2.0	3.0	1.6	3.1	2.4	3.6	3.4
22.00	3.3	3.4	3.0	3.8	3.0	3.8	3.5	4.0	3.8
24.00	4.3	4.4	3.5	4.3	3.9	4.3	4.0	5.2	5.0
26.00	4.8	5.0	4.8	5.3	5.5	5.2	5.4	5.9	5.6
28.00	6.3	6.4	6.1	6.7	6.1	6.6	6.8	7.4	7.1
30.00	7.4	7.6	7.4	7.8	7.9	7.7	8.2	8.7	8.4
32.00	9.8	9.8	8.4	9.3	9.1	9.2	9.3	10.9	10.7
34.00	10.3	10.4	10.3	11.2	10.3	11.0	11.4	11.5	11.3
36.00	13.1	13.1	11.8	13.3	12.3	13.1	12.9	14.1	13.9
38.00	14.8	14.8	13.7	15.2	14.4	15.0	14.9	15.8	15.6
40.00	17.4	17.3	15.8	17.6	15.9	17.5	17.0	18.4	18.2
42.00	18.7	18.7	18.8	20.3	18.6	20.2	19.9	19.8	19.6
44.00	21.7	21.6	20.2	21.9	21.4	21.8	21.5	22.9	22.6
46.00	24.1	24.0	24.0	24.9	25.1	24.8	25.3	25.6	25.3
48.00	26.6	26.5	26.9	28.0	26.6	27.8	28.6	28.3	28.0
50.00	29.5	29.4	29.7	30.2	30.9	30.0	31.2	31.5	31.2
52.00	32.5	32.4	32.3	33.0	34.1	32.8	34.4	34.8	34.4
54.00	34.3	34.3	35.8	36.3	37.4	36.0	37.8	36.8	36.5
56.00	37.9	37.8	39.1	40.2	40.8	39.9	41.7	40.3	40.0
58.00	40.9	40.8	41.5	42.7	44.3	42.4	43.9	43.5	43.4
60.00	44.0	43.8	44.9	46.5	47.5	46.3	47.6	46.3	46.3
62.00	46.4	46.2	48.3	49.8	50.3	49.6	50.9	48.8	48.9
64.00	50.6	50.3	50.6	52.3	53.6	52.3	53.5	52.4	52.8
66.00	53.4	53.1	54.5	55.7	57.1	55.8	57.1	55.2	55.7
68.00	56.4	56.1	57.3	58.4	58.7	58.7	59.6	57.9	58.6
70.00	59.2	58.9	60.5	61.1	62.2	61.4	62.4	60.5	61.2
72.00	62.2	61.9	62.8	63.3	65.6	63.7	64.6	63.2	63.9
74.00	63.9	63.7	66.1	66.2	68.1	66.5	67.4	65.0	65.7
76.00	66.9	66.7	68.7	68.7	70.6	69.1	69.6	67.7	68.2
78.00	69.2	69.2	70.4	70.4	73.0	70.7	71.3	69.8	70.3
80.00	71.2	71.2	73.0	72.9	75.0	73.1	73.5	71.7	72.1

TABLE B13

ENCIRCLED ENERGY

Task 2.3B - Nominal + Mfg. Error + First Temperature -15° Off Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
10.00	0.4	0.5	0.2	0.5	0.4	0.4	0.3	0.5	0.5
15.00	1.5	1.6	0.8	1.6	0.8	1.6	1.0	1.8	1.7
20.00	2.9	3.1	2.0	3.0	1.6	3.1	2.4	3.6	3.4
25.00	4.6	4.8	4.6	5.0	4.4	5.0	5.2	5.6	5.4
30.00	7.4	7.6	7.4	7.8	7.9	7.7	8.2	8.7	8.4
35.00	12.0	12.1	10.6	11.9	11.8	11.8	11.7	13.0	12.8
40.00	17.4	17.3	15.8	17.6	15.9	17.5	17.0	18.4	18.2
45.00	22.8	22.7	22.8	23.7	22.8	23.6	23.9	24.1	23.9
50.00	29.5	29.4	29.7	30.2	30.9	30.0	31.2	31.5	31.2
55.00	36.6	36.6	37.1	38.0	40.0	37.7	39.4	39.0	38.7
60.00	44.0	43.8	44.9	46.5	47.5	46.3	47.6	46.3	46.3
65.00	51.7	51.4	53.1	54.5	55.1	54.5	55.7	53.5	54.0
70.00	59.2	58.9	60.5	61.1	62.2	61.4	62.4	60.5	61.2
75.00	65.9	65.7	67.0	67.2	69.6	67.6	68.4	66.6	67.2
80.00	71.2	71.2	73.0	72.9	75.0	73.1	73.5	71.7	72.1
85.00	75.6	75.7	77.7	77.6	79.0	77.6	78.0	76.1	76.3
90.00	79.5	79.6	80.8	80.7	81.9	80.7	80.9	79.7	79.9
95.00	82.4	82.5	83.1	83.0	83.8	83.1	83.2	82.5	82.6
100.00	84.4	84.5	84.9	84.8	85.2	84.8	84.8	84.4	84.4
105.00	85.8	85.9	86.2	86.1	86.4	86.1	86.0	85.9	85.7
110.00	87.0	87.2	87.3	87.2	87.4	87.2	87.1	87.1	86.9
115.00	88.0	88.1	88.1	88.1	88.2	88.2	88.1	88.1	88.0
120.00	88.9	88.9	88.9	89.0	89.1	89.0	89.1	88.9	88.9
125.00	89.6	89.6	89.7	89.8	90.0	89.8	89.8	89.6	89.6
130.00	90.3	90.3	90.5	90.5	90.6	90.5	90.5	90.3	90.3
135.00	90.9	90.9	91.0	91.0	91.1	91.0	91.1	91.0	91.0
140.00	91.4	91.4	91.5	91.6	91.6	91.5	91.6	91.6	91.5
145.00	91.9	91.8	91.9	92.0	91.9	92.0	92.0	92.0	91.9
150.00	92.3	92.3	92.3	92.4	92.4	92.4	92.4	92.3	92.4
155.00	92.8	92.7	92.8	92.8	92.8	92.8	92.8	92.7	92.7
160.00	93.2	93.2	93.2	93.1	93.1	93.1	93.1	93.1	93.1
165.00	93.5	93.6	93.6	93.5	93.5	93.6	93.5	93.5	93.5
170.00	93.9	93.9	93.9	93.9	94.0	93.9	93.8	93.8	93.8
175.00	94.2	94.2	94.2	94.2	94.3	94.2	94.2	94.2	94.2
180.00	94.5	94.5	94.5	94.6	94.6	94.6	94.6	94.5	94.6
184.99	94.8	94.8	94.8	94.8	94.8	94.8	94.9	94.9	94.9
189.99	95.1	95.1	95.1	95.1	95.2	95.2	95.2	95.2	95.2
194.99	95.3	95.4	95.4	95.4	95.4	95.4	95.4	95.4	95.4
199.99	95.7	95.7	95.7	95.7	95.7	95.7	95.7	95.7	95.7

FIGURE B36

Wavefront Map-O Polarization

B50

Task 2.3B - Nominal + Mfg. Error + First Temperature -15° Off Axis

MAP IN UNITS OF 0.01 WAVES

```
                                        272 264 270 276
                                312 300 288 277 266 258 265 271 277 283 290 296
                            323 315 305 294 282 271 261 254 260 266 273 280 287 294 303 307
                        319 313 305 296 286 275 264 255 249 254 260 267 275 282 289 296 303 310
                    312 310 307 302 295 286 276 266 257 248 242 247 253 260 267 275 282 290 297 304 311 318
                301 300 298 295 291 285 277 268 258 249 241 234 239 245 252 259 266 274 281 288 296 303 310 317
                291 290 288 286 282 276 268 260 251 242 234 227 232 238 244 250 257 265 272 279 287 294 302 309
            284 277 276 281 278 274 268 261 253 244 236 228 221 224 230 236 242 248 256 263 271 278 286 278 288 299
        295 288 281 274 267 258 267 261 254 247 238 233 222 215 217 223 228 234 240 247 254 262 255 267 278 288 298 307
        299 292 285 278 270 261 251 241 231 241 233 225 217 209 211 215 221 226 232 222 233 245 257 268 279 288 298 306
    308 301 295 288 280 272 262 252 241 230 220 210 219 211 203 204 208 213 203 214 224 236 247 259 270 280 289 297 305 313
311 304 297 289 281 272 262 251 239 228 218 208 198 188 196 196 187 196 206 217 227 238 250 261 271 281 289 297 304 312
312 305 297 289 281 271 260 249 237 226 215 205 195 204 200 200 207 199 209 219 229 240 251 262 272 281 289 296 303 310
    306 298 289 279 269 258 246 235 223 212 222 217 211 207 206 214 222 229 220 231 241 251 262 271 279 287 294 300
    306 298 288 278 267 256 244 233 242 236 230 224 219 214 212 219 227 235 243 251 240 250 260 269 276 284 290 297
        298 288 278 267 273 266 258 251 244 237 231 226 221 218 225 233 241 249 257 264 270 274 265 273 280 286
    299 289 297 290 282 274 267 260 252 246 239 233 228 224 231 239 247 256 264 271 277 281 284 286 276 283
        313 306 298 291 283 276 269 261 254 247 241 235 231 237 245 254 263 272 280 286 290 293 294 295
            314 307 299 292 285 278 270 263 256 249 243 238 244 252 262 272 281 289 296 300 303 305
                314 307 300 293 285 278 271 263 257 250 245 252 260 270 281 291 300 307 312 316
                312 305 298 291 284 277 270 263 257 251 258 268 278 289 300 310 318 324
                    301 295 288 281 275 268 262 256 264 274 285 297 308 318
                        291 284 278 272 267 260 269 279 290 302
```

Q-238

ADD	Q POLARI	AVERAGE	AVERAGE	QUARTER	TEMPERAT	
1						
NONE		RMS	0.30	PK-PK	1.37	FRED	WAVEFRONT

FIGURE B37

Wavefront Plot-Q Polarization

Task 2.3B - Nominal + Mfg. Error + First Temperature -15° Off Axis

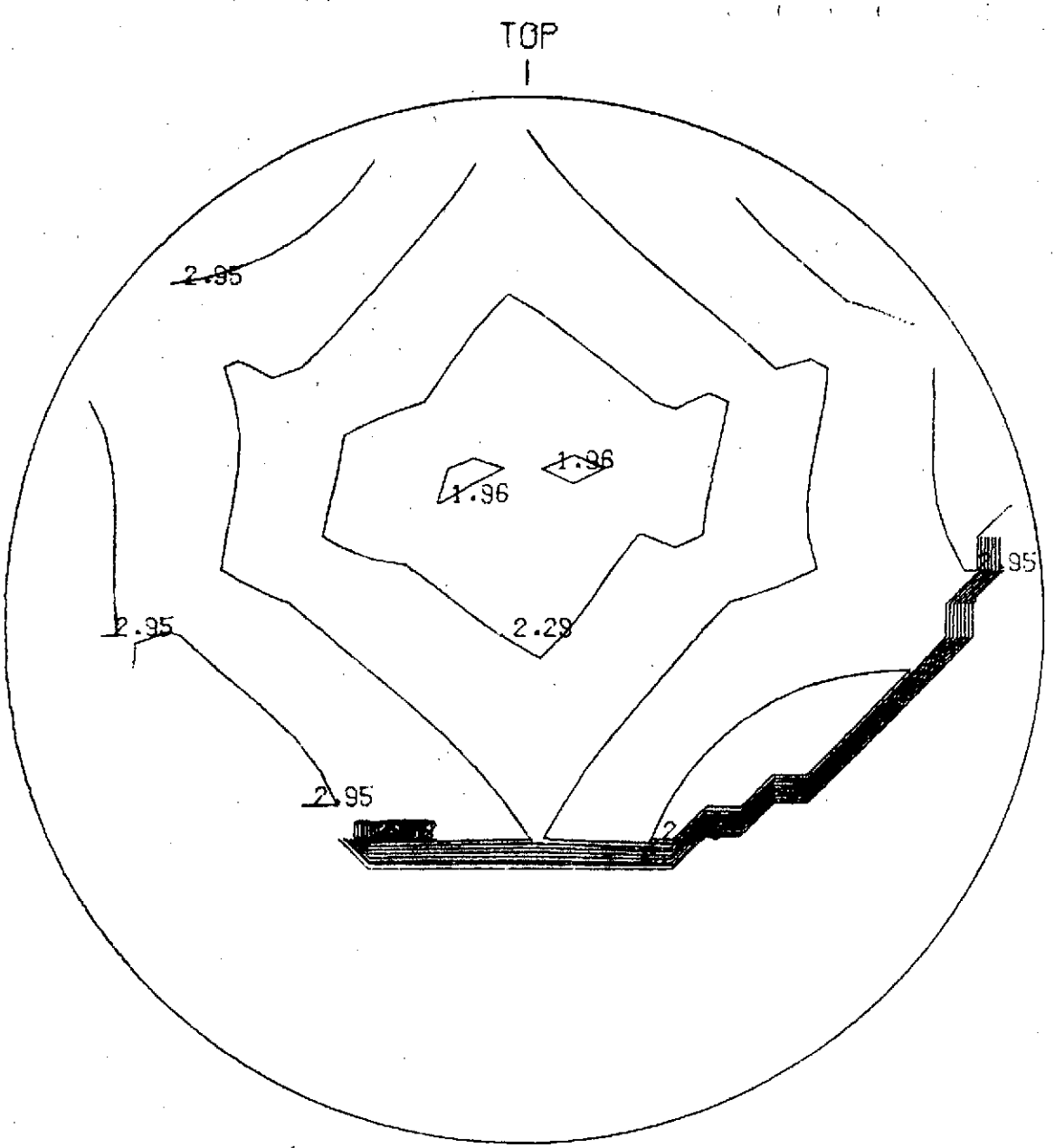


FIGURE B38

Wavefront Map-P Polarisation

Task 2.3B - Nominal + Mfg. Error + First Temperature -35° Off Axis

B52

MAP IN UNITS OF 0.01 WAVES

```
                                                  242 233  90  95
                                          281 269 257 246 236 228  84  90  96 103 109 115
                                      293 284 274 263 252 241 231 223  79  85  92  99 106 113 120 127
                                  288 282 275 265 255 244 234 225 218  74  80  87  94 101 108 116 123 130
                              282 279 276 271 264 256 246 236 226 218 211  67  73  79  87  94 102 109 116 123 130 137
                          271 269 268 265 260 254 246 237 227 218 210 204  59  65  71  78  86  93 101 108 115 122 130 137
                          261 260 258 255 251 245 238 229 220 211 203 197  51  57  63  70  77  84  91  99 106 114 121 129
                      301 294 287 250 248 243 237 230 222 214 205 197 190  44  49  55  61  68  75  82  90  98 105 145 155 165
                  311 305 298 291 283 275 236 230 224 216 208 200 192 185  37  42  47  53  60  66  74  81 122 134 145 155 165 174
                  315 308 302 294 286 277 267 257 247 210 202 194 186 179  30  35  40  46  52  89 100 112 124 135 146 155 164 173
              325 318 311 304 297 288 279 268 257 247 236 227 188 180 173  23  28  32  70  81  91 103 114 126 137 147 156 164 172 180
              327 320 313 306 297 288 278 267 256 245 235 224 214 205 166  15  54  63  73  84  94 105 117 128 138 148 156 164 171 179
              329 321 314 306 297 287 277 265 253 242 232 221 211  33  28 178 186  66  76  86  96 107 118 129 139 148 156 163 170 177
              322 314 305 296 285 274 263 251 240 229  51  45  40  36 185 192 200 208  87  98 108 118 129 138 146 154 161 167
              323 314 305 295 284 272 261 249  71  65  58  53  47  42 191 198 206 214 222 229 107 117 127 136 143 151 157 164
                  314 305 294 283 102  94  87  79  72  66  60  54  49 196 204 211 220 228 236 243 249 253 132 140 147 153
              315 305 126 118 111 103  96  88  81  74  68  62  56 203 209 217 226 234 243 250 256 260 263 264 143 150
                  142 134 127 119 112 105  97  90  83  76  70  64 209 216 224 232 242 250 258 264 269 271 273 274
                      142 135 128 121 114 106  99  91  84  78  72 216 223 231 240 250 260 268 274 279 282 284
                      143 136 129 122 114 107  99  92  85  79 224 230 239 249 259 269 278 286 291 294
                      141 134 127 120 113 106  99  92  86 230 237 246 257 268 279 288 296 303
                          130 124 117 110 103  97  91 235 242 252 264 275 287 297
                              119 113 107 101  95 239 247 258 269 281
```

ADD 1	P POLARI	AVERAGE	AVERAGE	QUARTER	TEMPERAT	
NONE	RMS	0.84	PK-PK	3.13	FRED	WAVEFRONT

FIGURE B39

Wavefront Plot-P Polarization

Task 2.3B - Nominal + Mfg. Error + First Temperature -15° Off Axis

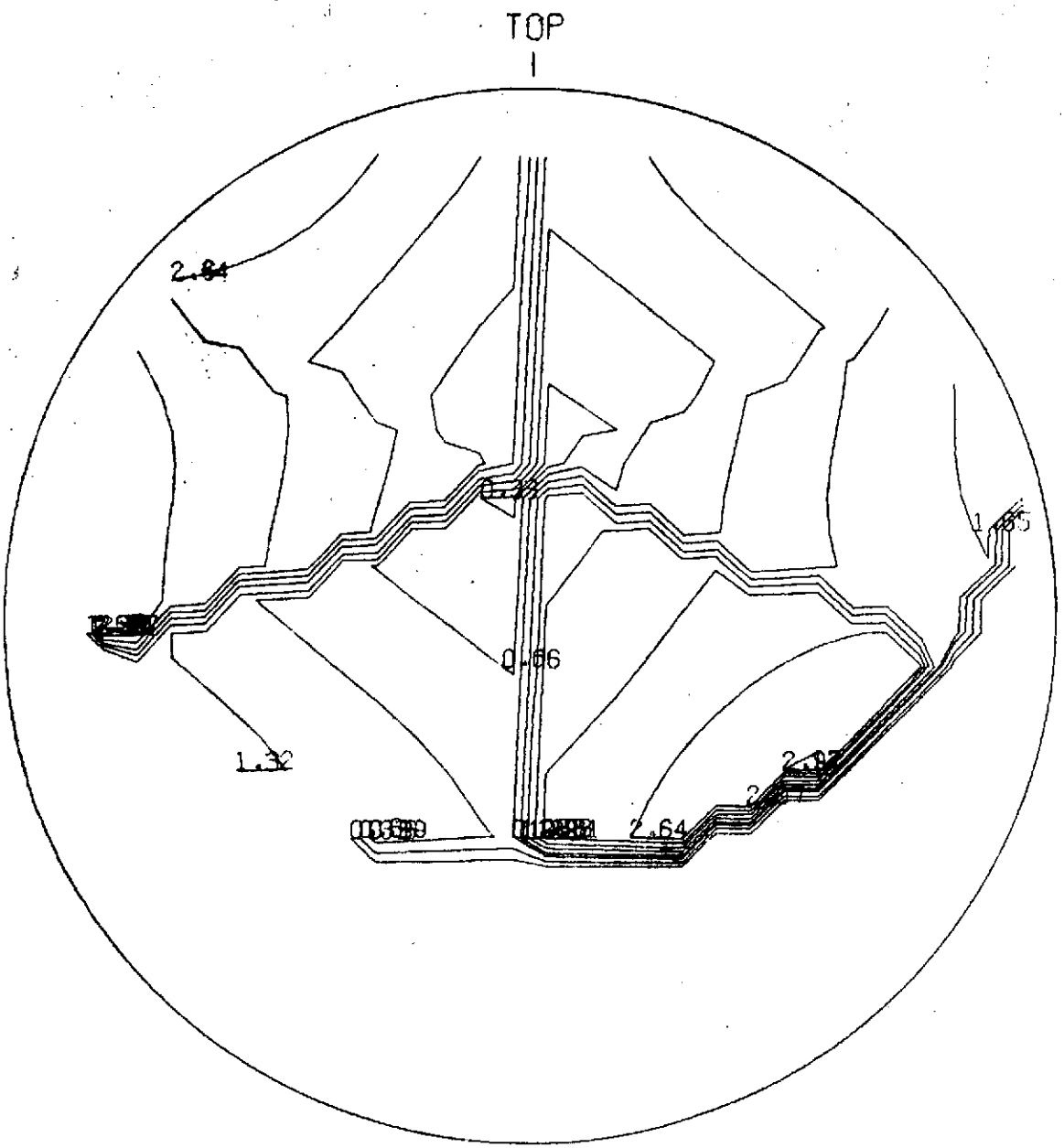


FIGURE B40

Task 2.3B - Nominal + Mfg. Error + First Temperature -15° Off Axis

PRINTER MAP OF POINT SPREAD FUNCTION

B54

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0155 = 100
TOTAL ENERGY = 0.1870400D+01
MAP REPRESENTS 0.1738362D+01 OR 92.9407 PERCENT OF TOTAL ENERGY

```
    0  1  1  1  1  1  1  1  0  0  0  0  0  0  0  1  1  1  1  2  1  0  0  0  0  0  0  1  1  1  1  0  0  1  1
    0  1  1  1  1  1  1  1  0  1  1  1  0  0  0  0  1  1  0  1  2  1  0  1  0  0  0  1  1  0  1  1  1  1  0  0  1  1
    0  0  0  1  1  1  1  1  2  2  1  1  0  0  0  0  2  2  0  2  4  3  1  0  0  0  0  1  1  0  1  1  1  1  1  0  0  0
    0  0  0  0  0  0  1  2  2  1  2  1  0  0  0  1  3  4  2  3  5  3  1  0  0  0  1  1  1  1  1  1  1  0  0  0  0  0
    0  0  0  1  1  0  1  2  1  2  3  1  0  1  2  4  4  3  5  5  2  1  1  0  0  1  1  1  2  1  1  0  0  1  0  0  0  0
    0  0  1  1  2  1  1  2  2  3  2  1  2  2  1  3  3  3  5  4  1  2  3  1  1  2  2  2  1  1  1  1  1  0  0  0  0  0
    0  0  1  2  2  2  3  3  3  3  2  2  5  3  2  4  3  2  4  5  3  2  4  4  2  2  3  3  2  1  2  0  1  1  1  0  0  0
    0  1  1  1  2  2  3  3  2  3  4  7  8  5  7  8  4  3  5  9  8  5  6  8  5  3  2  3  2  1  2  0  0  1  0  0  0  0
    0  1  1  1  1  1  2  2  3  6  9 13 14 13 15 11  5  6  8 13 15 15 16 14  9  5  2  1  1  1  1  1  1  0  0  0  0  0
    1  1  1  2  1  1  2  3  5  8 14 19 21 23 21 10  6  8  7 10 18 24 28 23 13  8  4  1  1  1  1  2  1  1  0  0  0  0
    2  1  1  2  2  2  5  6  6 11 21 26 27 29 21 10  9 10 11 17 21 26 31 30 20  9  4  1  1  1  1  1  1  1  1  0  0  0
    2  2  1  2  3  6 10 10 11 22 34 34 37 39 26 15 11  7 14 24 28 33 35 36 32 15  6  4  3  3  3  3  2  2  2  0  0  0
    2  2  1  3  5  8 11 15 23 38 43 41 54 57 37 24 15  5 10 20 35 55 53 45 45 28 14 10  6  5  5  5  3  2  2  0  0  0
    1  1  2  3  5  6  8 14 27 39 38 45 68 63 39 30 18  8 10 16 36 70 71 50 46 33 18 11  4  3  4  4  2  1  1  0  0  0
    1  1  1  2  2  2  4 10 21 29 32 51 69 47 32 29 13  6 13 25 38 62 70 50 37 27 16  8  2  1  2  2  1  0  1  0  0  0
    1  1  0  1  2  2  4  7 15 24 34 54 56 29 33 30  5  3 10 33 44 42 56 51 35 25 15  6  1  1  1  2  1  1  1  0  0  0
    1  0  0  1  2  3  4  6 12 21 29 39 31 19 40 29  4 10  4 28 44 24 34 43 32 25 18  7  2  1  1  1  1  0  0  0  0  0
    0  0  1  1  1  1  2  6 10 14 14 15 11 15 39 23  6 18  4 21 38 13 14 19 16 19 17  9  3  0  0  1  1  0  0  0  0  0
    0  1  2  1  1  0  3  9  9  8  7 13 24 31 42 27  7 10  7 28 38 21 21 12  4 10 12 11  7  3  1  1  1  1  0  0  0  0
    0  1  2  1  1  1  4  8  5  5 14 35 63 64 54 41 14  1 14 39 44 50 59 33  9  4  5  9  9  5  2  1  1  1  1  0  0  0
    0  1  1  1  0  1  2  4  2  9 29 58 93 88 56 37 18  5 20 38 46 75 90 55 23  9  2  4  5  4  2  1  1  1  0  0  0  0
    1  1  1  1  1  2  2  4  9 25 55 80100 87 43 17  9  9 18 27 43 78 89 66 48 29 10  3  2  2  2  3  2  1  0  0  0  0
    1  2  2  2  2  2  3  7 17 39 74 92 88 69 37 14  5  6 12 20 40 66 75 76 72 49 23 10  4  2  2  2  2  1  1  0  0  0
    1  1  1  1  1  2  2  7 15 31 60 74 60 42 34 27 15  8 11 22 36 48 59 70 66 42 24 15  8  3  1  1  1  1  1  0  0  0
    1  1  1  1  1  1  1  3  8 13 27 38 33 23 23 26 20 12 13 21 27 31 35 42 32 19 15 13  8  3  1  1  0  1  0  0  0  0
    0  1  0  1  1  1  1  1  3  4  8 15 22 18 14 14 14 11  9 13 18 21 23 16  9  6  7  6  4  2  2  1  0  0  0  0  0  0
    0  0  0  0  1  2  1  1  3  3  5  9 16 18 13  8  8  7  5  7 12 14 13  7  4  3  1  1  1  1  1  0  0  0  0  0  0  0
    0  0  0  0  1  2  2  3  2  2  5  7  8 10 12 10  5  3  4  7  8  8  7  4  4  2  1  2  1  0  1  0  0  0  0  0  0  0
    0  0  0  0  1  2  2  5  6  4  3  4  3  3  8 10  4  2  4  6  4  3  2  2  3  4  5  5  3  1  1  0  0  0  0  0  0  0
    0  0  0  0  1  2  2  3  5  4  1  2  2  1  4  7  5  2  3  3  1  1  1  1  3  5  6  4  2  2  2  1  0  0  0  0  0  0
    1  0  0  0  0  1  1  1  2  2  0  0  1  0  2  5  5  3  2  2  1  0  0  2  3  3  2  1  1  2  2  1  0  0  0  0  0  0
    0  0  0  1  1  0  0  0  0  0  0  0  1  1  2  3  3  1  2  2  1  0  0  1  2  1  1  1  0  1  1  0  0  0  0  0  0  0
    0  0  0  1  1  1  0  0  0  0  0  0  1  3  3  1  0  2  2  1  0  0  1  1  1  1  0  0  1  1  1  0  0  0  0  0  0  0
    0  0  0  1  1  2  2  1  0  0  0  0  1  1  2  2  1  0  1  1  1  0  0  0  1  1  0  0  0  2  2  1  0  0  0  0  0  0
    0  0  0  1  1  2  2  1  0  0  0  0  1  1  1  0  1  1  1  1  1  1  1  0  0  0  0  0  0  2  3  2  1  1  1  0  0  0
ID
ID
```

ID
ID
NONE RMS 2.22 PK-PK 10.03 FRED WAVEFRONT

FIGURE B41

Intensity Distriubtion - Central 129 Microradians

Task 2.3B - Nominal + Mfg. Error + First Temperature -15° Off Axis

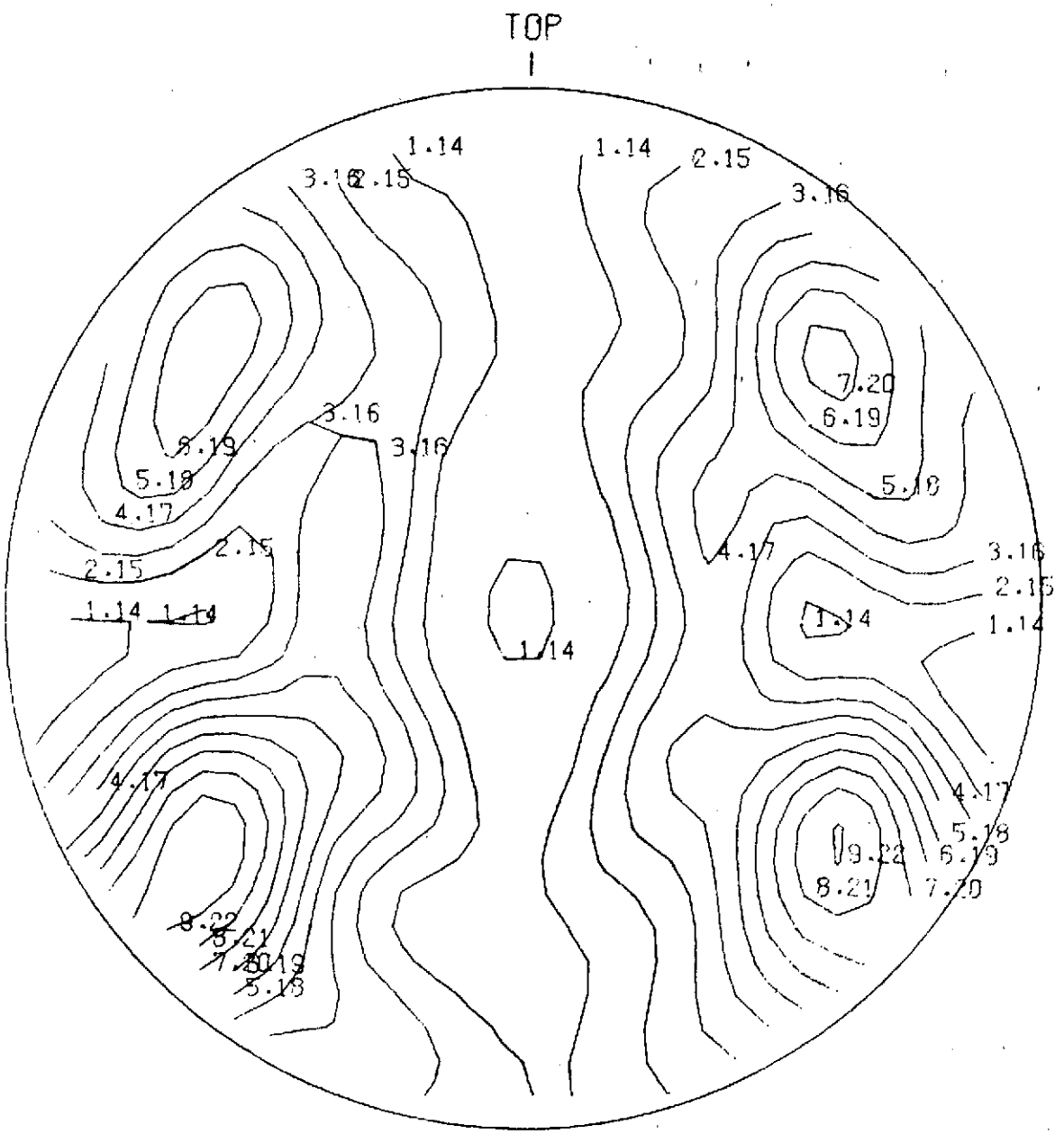


FIGURE 842

Encircled Energy

Vs

Field Angle

Task 2.3B - Nominal + Mfg. Error

+ First Temperature -15° Off Axis

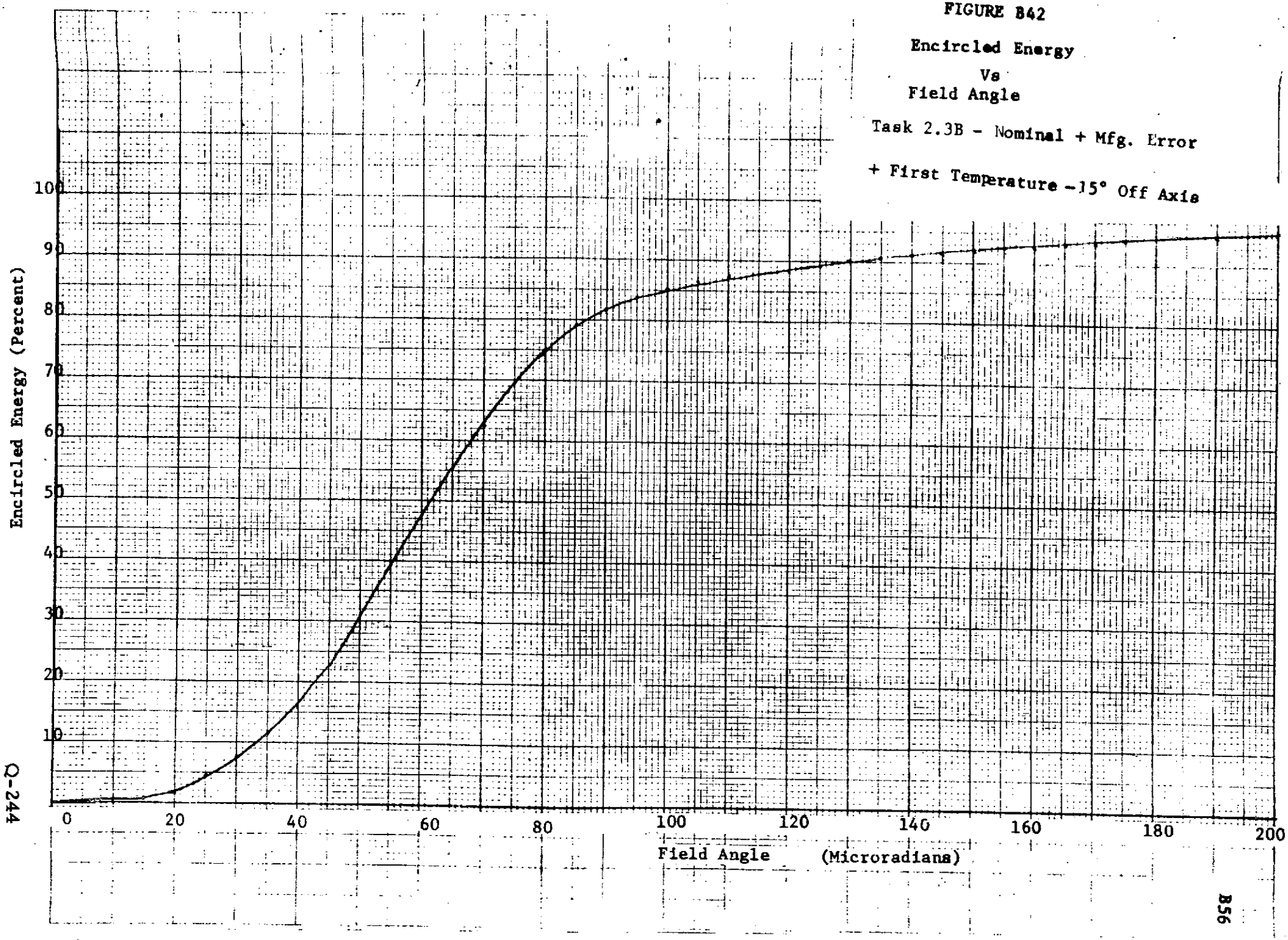


TABLE B14

ENCIRCLED ENERGY

Task 2.3A1 - Nominal + Mfg. Error + Second Temperature

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.00	0.1	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.1
6.00	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1
8.00	0.4	0.3	0.2	0.4	0.2	0.3	0.2	0.2	0.4
10.00	0.5	0.4	0.3	0.5	0.4	0.5	0.3	0.4	0.5
12.00	1.1	0.9	0.5	0.8	0.5	0.7	0.6	0.8	1.0
14.00	1.1	0.9	1.0	1.0	0.8	1.0	1.0	0.8	1.0
16.00	1.8	1.6	1.3	1.3	1.0	1.3	1.4	1.5	1.5
18.00	2.1	1.9	1.9	1.6	1.8	1.6	1.8	1.9	1.8
20.00	2.8	2.7	2.6	2.1	1.8	2.1	2.6	2.7	2.6
22.00	3.1	3.0	3.4	2.7	2.8	2.6	3.3	3.1	3.0
24.00	4.3	4.3	4.2	3.3	3.3	3.3	4.0	4.5	4.3
26.00	4.9	5.0	5.2	4.1	4.4	4.1	5.0	5.2	5.0
28.00	6.8	7.1	6.9	5.5	4.7	5.5	6.9	7.3	7.0
30.00	7.9	8.3	7.9	6.8	6.4	6.8	8.1	8.7	8.3
32.00	10.4	11.0	9.6	8.1	7.2	8.1	10.1	11.6	11.0
34.00	11.0	11.7	11.3	10.4	9.5	10.3	12.1	12.2	11.6
36.00	13.8	14.8	13.4	12.1	11.4	12.0	14.6	15.5	14.5
38.00	15.2	16.2	15.5	14.7	15.0	14.6	16.8	17.2	16.2
40.00	18.0	19.2	18.1	16.9	16.8	16.8	19.6	20.5	19.1
42.00	19.4	20.6	21.1	20.5	21.6	20.5	22.5	21.9	20.6
44.00	22.9	24.1	23.6	22.7	23.8	22.5	25.2	25.7	24.3
46.00	25.5	26.5	26.8	27.2	28.8	27.0	28.4	28.3	27.0
48.00	29.2	30.2	31.0	30.9	30.2	30.6	32.5	32.2	30.7
50.00	32.4	33.2	33.4	34.2	35.1	34.0	35.1	35.3	34.0
52.00	36.6	37.2	37.4	37.9	37.8	37.6	38.9	39.3	38.1
54.00	39.0	39.5	40.3	41.7	42.6	41.5	42.1	41.6	40.3
56.00	43.3	43.7	44.9	45.6	45.7	45.4	46.6	45.5	44.5
58.00	46.4	46.8	47.6	48.6	50.7	48.4	49.4	48.5	47.6
60.00	49.8	50.2	51.5	52.2	54.1	52.1	53.1	51.7	51.1
62.00	52.3	52.6	54.7	56.1	58.1	56.0	56.2	53.8	53.4
64.00	56.5	56.5	57.6	58.7	61.2	58.6	58.9	57.5	57.5
66.00	58.9	59.0	60.9	62.6	64.8	62.5	61.9	59.8	59.9
68.00	62.5	62.4	63.8	64.9	66.5	64.9	64.4	63.1	63.4
70.00	64.7	64.4	66.4	67.8	69.3	67.7	66.8	64.9	65.4
72.00	67.5	67.5	68.8	69.8	71.5	69.8	69.0	67.8	68.4
74.00	69.6	69.0	71.2	72.0	73.4	72.1	71.2	69.3	69.9
76.00	72.3	71.6	73.4	73.7	74.9	73.8	73.3	71.7	72.5
78.00	74.0	73.2	74.7	75.1	76.5	75.1	74.6	73.2	74.0
80.00	75.8	74.9	76.4	76.5	77.6	76.6	76.4	74.9	75.9

TABLE B15

ENCIRCLED ENERGY

Task 2.3A1 - Nominal + Mfg. Error + Second Temperature

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.1	0.1	0.0	0.2	0.1	0.2	0.1	0.1	0.1
10.00	0.5	0.4	0.3	0.5	0.4	0.5	0.3	0.4	0.5
15.00	1.5	1.3	1.2	1.2	1.0	1.2	1.2	1.3	1.3
20.00	2.8	2.7	2.6	2.1	1.8	2.1	2.6	2.7	2.6
25.00	4.7	4.8	4.9	4.0	3.7	4.0	4.7	5.0	4.8
30.00	7.9	8.3	7.9	6.8	6.4	6.8	8.1	8.7	8.3
35.00	12.6	13.5	12.3	10.8	10.8	10.8	13.2	14.2	13.3
40.00	18.0	19.2	18.1	16.9	16.8	16.8	19.6	20.5	19.1
45.00	24.3	25.4	25.3	25.7	26.8	25.5	27.0	27.2	25.7
50.00	32.4	33.2	33.4	34.2	35.1	34.0	35.1	35.3	34.0
55.00	41.8	42.2	43.0	43.6	44.9	43.4	44.6	44.0	43.1
60.00	49.8	50.2	51.5	52.2	54.1	52.1	53.1	51.7	51.1
65.00	57.6	57.7	59.7	61.1	63.4	60.9	60.8	58.6	58.6
70.00	64.7	64.4	66.4	67.8	69.3	67.7	66.8	64.9	65.4
75.00	71.2	70.5	72.3	72.9	74.2	73.0	72.3	70.7	71.4
80.00	75.8	74.9	76.4	76.5	77.6	76.6	76.4	74.9	75.9
85.00	79.1	78.0	79.5	79.7	80.3	79.7	79.6	78.2	79.2
90.00	81.6	80.7	81.6	82.0	82.3	82.0	81.9	80.9	81.8
95.00	83.7	83.2	83.5	83.8	84.0	83.9	83.7	83.3	83.8
100.00	85.2	85.0	85.2	85.4	85.6	85.5	85.3	85.0	85.3
105.00	86.4	86.5	86.7	86.8	87.1	86.9	86.8	86.5	86.5
110.00	87.6	87.8	88.0	88.0	88.3	88.1	88.0	87.9	87.7
115.00	88.7	89.0	89.0	89.0	89.3	89.0	89.1	89.0	88.8
120.00	89.7	90.0	90.0	89.9	90.1	89.9	90.0	89.9	89.7
125.00	90.4	90.7	90.7	90.7	90.8	90.7	90.8	90.7	90.5
130.00	91.2	91.3	91.4	91.3	91.4	91.3	91.4	91.3	91.2
135.00	91.9	91.8	91.9	91.9	92.0	91.9	91.9	91.8	91.8
140.00	92.3	92.3	92.4	92.5	92.4	92.4	92.4	92.3	92.3
145.00	92.8	92.8	92.8	92.9	92.8	92.9	92.8	92.8	92.7
150.00	93.1	93.2	93.2	93.3	93.3	93.3	93.3	93.2	93.1
155.00	93.5	93.6	93.6	93.6	93.7	93.6	93.6	93.6	93.5
160.00	93.9	93.9	93.9	93.9	94.0	93.9	93.9	93.9	93.9
165.00	94.3	94.2	94.3	94.3	94.2	94.3	94.3	94.2	94.2
170.00	94.6	94.5	94.6	94.6	94.5	94.6	94.5	94.5	94.5
175.00	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8
180.00	95.1	95.1	95.1	95.1	95.2	95.2	95.1	95.1	95.1
184.99	95.4	95.4	95.4	95.4	95.4	95.4	95.4	95.4	95.4
189.99	95.6	95.6	95.7	95.7	95.7	95.7	95.7	95.7	95.7
194.99	95.9	95.9	95.9	95.9	96.0	95.9	95.9	95.9	95.9
199.99	96.2	96.2	96.1	96.2	96.2	96.2	96.1	96.2	96.2

FIGURE B43

Wavefront Map-0 Polarization

Task 2.3A1 - Nominal + Mfg. Error + Second Temperature

859

MAP IN UNITS OF 0.01 WAVES

145 138 132 126 121 134 138 139 141 145

161 153 145 137 131 125 119 114 130 134 135 137 141 149 158 167

159 152 144 136 129 124 119 113 108 122 127 129 131 136 143 152 159 165

155 149 142 134 127 121 117 113 108 103 110 116 120 123 128 135 142 148 151 154

148 144 138 131 123 117 112 110 107 103 98 98 105 110 114 120 126 132 136 138 140 143

138 137 133 127 119 111 106 104 103 101 98 92 86 94 100 106 112 118 123 125 127 129 132 136

127 127 126 122 115 106 100 96 95 96 95 91 86 77 84 92 99 106 112 115 117 118 121 124 128 132

187 119 118 116 110 103 94 88 86 88 89 88 84 79 69 76 83 92 99 104 107 109 111 113 116 120 125 206

187 181 176 107 100 92 83 78 78 80 82 81 77 71 62 68 75 82 89 94 98 100 103 105 108 188 198 206

190 183 176 169 92 82 74 69 69 72 74 73 69 62 55 60 65 70 75 81 86 90 94 97 175 187 198 206

201 193 185 176 167 159 150 65 60 60 62 64 64 59 53 47 51 54 57 61 67 73 80 152 163 175 188 199 208 215

206 196 186 175 165 156 149 141 132 51 52 53 53 49 43 39 41 43 44 48 54 134 143 153 163 175 187 199 210 218

210 199 187 174 162 154 149 142 134 126 120 41 41 38 34 30 32 32 33 124 131 139 147 155 164 174 185 198 210 220

215 203 189 175 163 155 150 144 137 130 124 119 30 29 26 20 22 22 118 127 135 142 149 156 163 171 182 196 209 221

218 206 191 177 165 157 152 147 140 133 126 120 112 102 17 9 96 109 120 128 135 142 149 155 161 168 180 194 208 221

221 208 194 180 168 161 155 149 142 135 128 120 109 96 9 17 102 112 120 126 133 140 147 152 157 165 177 191 206 218

221 209 196 182 171 163 156 149 142 135 127 118 22 22 20 26 29 30 119 124 130 137 144 150 155 163 175 189 203 215

220 210 198 185 174 164 155 147 139 131 124 33 32 32 30 34 38 41 41 120 126 134 142 149 154 162 174 187 199 210

218 210 199 187 175 163 153 143 134 54 48 44 43 41 39 43 49 53 53 52 51 132 141 149 156 165 175 186 196 206

215 208 199 188 175 163 152 80 73 67 61 57 54 51 47 53 59 64 64 62 60 60 65 150 159 167 176 185 193 201

206 198 187 175 97 94 90 86 81 75 70 65 60 55 62 69 73 74 72 69 69 74 82 92 169 176 183 190

206 198 188 108 105 103 100 98 94 89 82 75 68 62 71 77 81 82 80 78 78 83 92 100 107 176 181 187

206 125 120 116 113 111 109 107 104 99 92 83 76 69 79 84 88 89 88 86 88 94 103 110 116 118 119 187

132 128 124 121 118 117 115 112 106 99 92 84 77 86 91 95 96 95 96 100 106 115 122 126 127 127

136 132 129 127 125 123 118 112 106 103 94 86 92 98 101 103 104 106 111 119 127 133 137 138

143 140 138 136 132 126 120 114 110 105 98 98 103 107 110 112 117 123 131 138 144 148

154 151 148 142 135 128 123 120 116 110 103 108 113 117 121 127 134 142 149 155

165 159 152 143 136 131 129 127 122 108 113 119 124 129 136 144 152 159

167 158 149 141 137 135 134 130 114 119 125 131 137 145 153 161

145 141 139 138 134 121 126 132 138 145

FIGURE B44

Wavefront Plot-Q Polarization

Task 2.3A1 - Nominal + Mfg. Error + Second Temperature

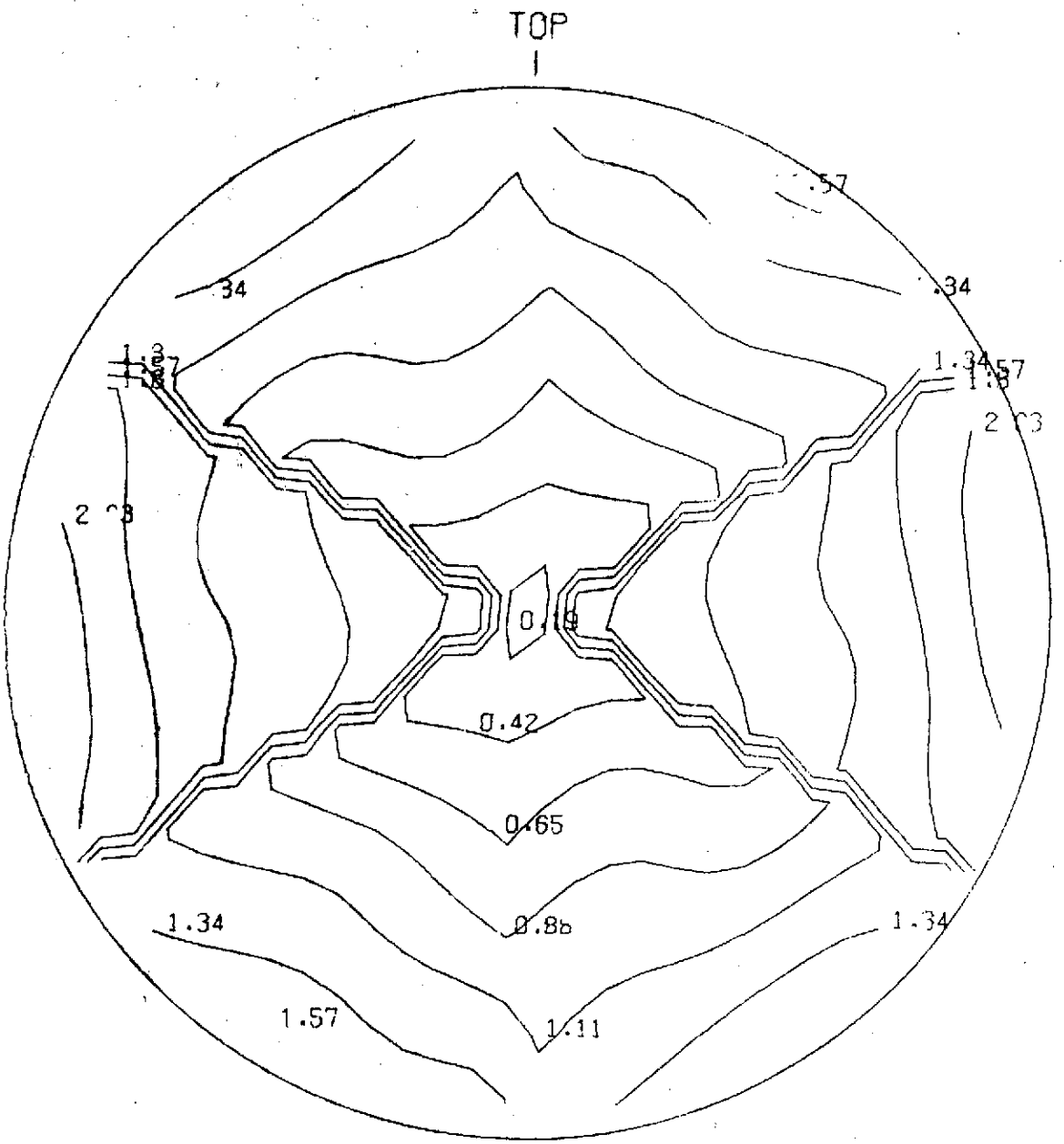


FIGURE 845

Wavefront Map-P Polarization

Task 2.3A1 - Nominal + Mfg. Error + Second Temperature

MAP IN UNITS OF 0.01 WAVES

254 246 240 235 230 93 96 98 99 104

270 262 253 245 239 233 228 222 89 92 94 96 100 107 117 126

268 260 252 244 238 232 227 222 216 81 85 87 89 94 102 110 118 123

264 257 250 242 235 229 225 221 217 211 69 75 78 81 87 94 101 106 110 112

256 253 247 239 232 225 221 218 216 212 206 56 63 68 73 78 85 90 94 97 99 101

246 245 242 235 227 220 214 212 211 210 206 201 45 52 58 65 71 77 81 84 86 88 91 94

235 235 234 230 223 215 208 204 204 204 203 200 194 35 43 50 58 65 70 74 75 77 79 82 86 91

252 227 226 224 219 211 203 197 195 196 197 197 193 187 27 34 42 50 57 63 66 68 69 71 74 79 84 122

253 247 242 235 229 220 192 187 186 188 191 190 185 179 20 26 33 41 47 52 56 59 61 64 67 104 114 121

256 249 242 235 201 191 182 177 177 180 183 182 177 170 13 18 23 28 34 39 44 49 53 56 91 103 114 122

267 259 251 242 233 225 216 174 169 168 171 173 172 168 161 6 9 12 15 20 25 32 38 68 79 91 104 115 124 131

272 262 252 241 231 222 215 207 198 159 160 162 161 157 151 -2 0 1 3 7 13 50 59 69 79 91 103 115 126 134

276 265 253 240 228 220 215 208 200 192 186 150 149 147 142 -11 -9 -8 -7 40 47 55 63 71 80 90 101 114 126 136

281 269 255 240 229 221 216 210 203 196 190 185 139 137 134 -21 -19 -18 34 43 51 58 65 72 79 87 98 112 125 137

284 272 257 243 231 223 218 213 206 199 192 186 178 168 126 -32 12 25 35 44 51 58 65 71 77 84 96 110 124 137

287 274 260 246 234 227 221 215 208 201 194 185 175 162 -20 138 18 28 36 42 49 56 63 68 73 81 93 107 122 134

287 275 262 248 237 229 222 215 208 201 193 184 -7 -7 -9 146 149 151 35 40 46 53 60 66 71 79 90 105 119 131

286 276 264 251 240 230 221 213 205 197 190 3 2 2 0 154 158 161 161 36 42 50 58 65 70 78 90 103 115 126

284 276 265 253 241 229 219 209 200 24 18 15 13 11 9 163 169 173 173 172 171 48 57 65 72 81 91 102 112 122

281 274 265 254 241 229 218 50 43 37 31 27 24 21 17 173 180 184 184 182 180 180 186 66 75 83 92 101 109 117

272 264 253 241 67 64 60 56 51 45 40 35 30 25 182 189 193 194 192 189 189 194 203 212 85 92 99 106

271 264 254 78 75 73 70 68 64 59 52 45 38 32 191 197 201 202 200 198 198 203 212 221 227 92 97 103

272 95 90 86 83 81 79 77 74 69 62 54 46 39 199 205 208 209 208 207 208 215 223 231 236 238 239 102

103 98 94 91 88 87 85 82 76 69 62 54 47 206 212 215 216 215 216 220 226 235 242 246 247 247

106 102 99 97 95 93 88 82 76 70 64 56 212 218 221 223 224 226 232 239 247 253 257 258

113 110 108 106 102 97 90 84 80 75 68 218 223 227 230 232 237 243 251 258 265 268

124 121 118 112 105 98 93 90 86 80 223 229 233 237 241 247 254 262 269 275

135 129 122 113 106 101 99 97 92 228 234 239 244 250 256 264 272 279

137 128 119 111 107 105 104 103 234 239 245 251 257 265 273 282

115 111 109 108 104 242 247 252 258 265

FIGURE 46

B62

Wavefront Plot-P Polarization

Task 2.3A1 - Nominal + Mfg. Error + Second Temperature

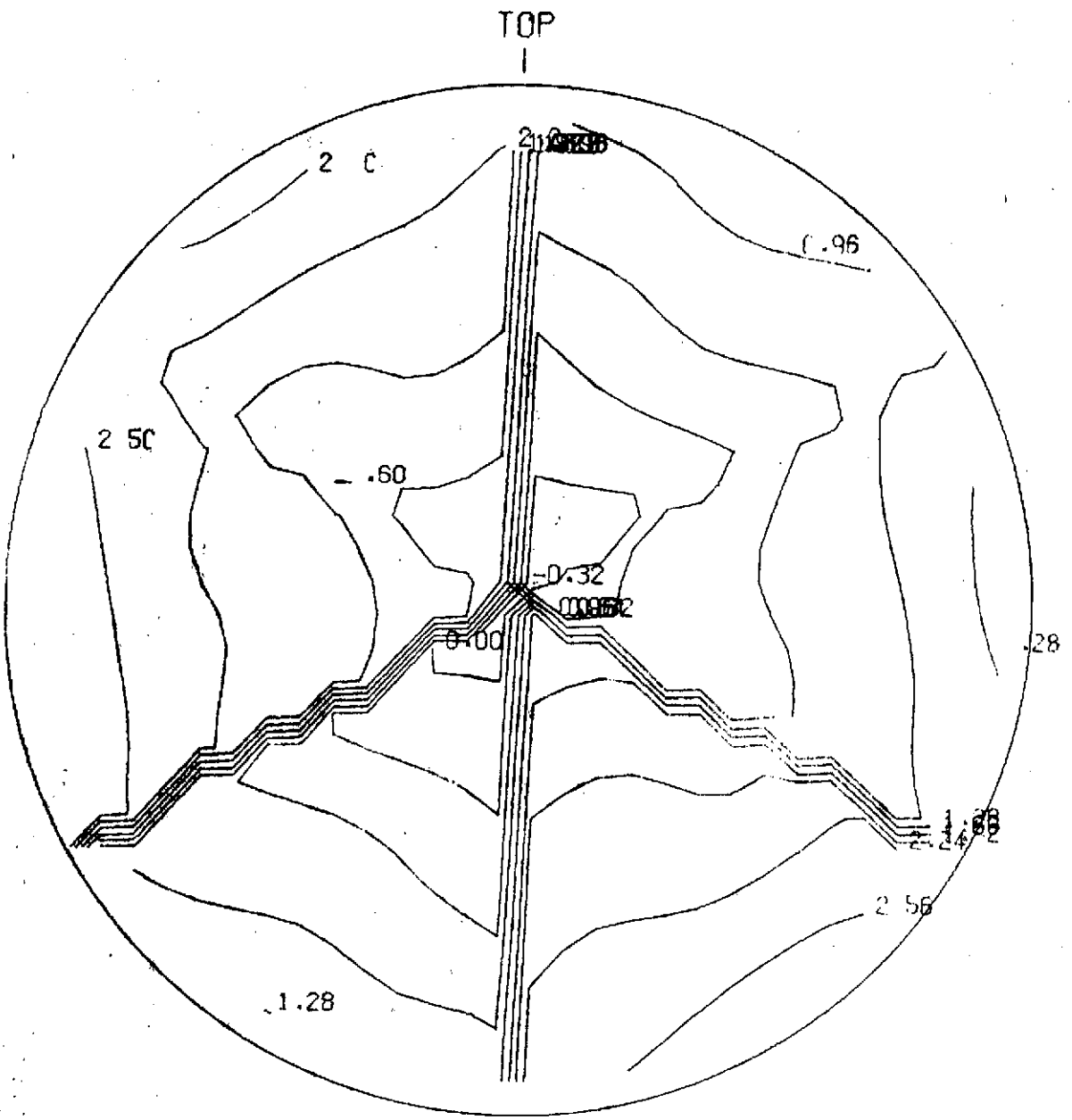


FIGURE 47

Task 2.3A1 - Nominal + Mfg. Error + Second Temperature

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0195 = 100
TOTAL ENERGY = J.2461J000+01
MAP REPRESENTS 0.23091100+01 OR 93.8281 PERCENT OF TOTAL ENERGY


```
 1  1  1  1  1  0  0  1  1  0  1  1  2  2  1  1  0  0  0  0  1  2  1  1  1  1  1  1  0  0  1  1  1  1  1  1
 1  1  1  1  1  0  0  0  1  1  1  1  0  1  2  3  3  1  0  0  1  3  3  2  1  1  1  1  1  1  0  1  1  1  1  1
 0  1  1  0  0  0  0  1  1  1  1  0  0  1  0  2  3  2  1  1  1  2  3  3  1  1  1  1  1  1  0  0  1  1  1  0
 0  0  0  0  0  0  1  1  1  1  1  1  0  1  2  2  3  3  1  1  2  2  2  1  1  1  1  1  1  1  0  0  0  1  1  0
 0  0  0  1  1  0  1  1  1  3  3  2  2  2  2  4  4  3  3  2  2  2  2  2  1  1  1  1  1  1  1  1  1  1  0  0
 0  0  0  1  1  0  1  1  2  4  4  4  4  2  3  6  9 11  8  4  3  2  2  2  2  2  0  0  2  1  1  1  0  0  0
 0  0  1  1  1  1  1  2  4  6  5  7  5  3  3  3 10 16  8  4  5  2  2  3  1  1  1  1  2  1  1  1  0  0  0
 1  0  0  1  1  2  2  4  7  6  8 10  6  6  7  5  8 12  9  9 12  7  3  4  2  0  1  2  1  1  1  1  0  0  0
 1  0  1  1  1  1  2  4  5  8 10  7  7 11 12 15 16 16 21 24 27 22 11  5  2  1  3  2  1  1  0  0  1  1  1
 0  0  1  1  1  2  2  2  3  7  6  9 18 22 27 34 35 39 44 41 38 35 24 12  4  4  4  2  2  1  0  0  0  1  1
 0  0  0  1  2  3  3  2  1  1  5 17 21 28 51 51 42 52 59 63 60 45 32 20 11  7  3  1  2  2  1  1  0  1  1
 1  1  2  2  2  4  5  5  3  2  8 21 28 48 67 52 53 74 66 69 85 74 47 29 19 10  5  4  2  1  1  2  2  2  1
 1  2  2  1  2  5  6  6  4  4  9 18 38 61 83 57 80100 78 59 75 72 43 31 22  9  7  6  3  1  1  2  2  2  1
 1  1  1  1  3  4  3  4  4  5 11 15 25 39 47 55 56 55 55 47 53 49 31 36 27 12 10  4  4  4  4  3  0  1  1
 1  0  1  2  3  2  1  4  7  7 13 16 17 22 34 38 20 20 34 29 26 30 34 42 29 21 20  5  5  7  6  4  0  1  1
 0  0  1  2  2  4  3  4  8 13 18 16 16 11 21 24  8 11 20 20  8 18 36 32 23 23 21  9  6  6  5  4  2  2  0
 1  1  1  3  4  6  5  5  7 22 29 17 25 16 19 30 13  2  3 19 19 41 54 27 25 22 14 11  7  5  5  5  3  2  1
 1  1  2  4  5  6  5  7  7 22 33 26 47 36 16 23 17 16 14 17 18 46 52 24 32 22  7  7  5  6  5  4  2  1  1
 1  2  2  5  4  5  5 10 14 22 41 40 46 30  5  8  2  3 15 20  9 16 21 23 40 24  8  3  2  6  4  3  1  1  1
 1  2  2  4  3  4  5 11 24 23 31 29 18 13  7 18 22 12 15 20 10  5  3 11 25 16 11  5  1  3  1  2  1  0  0
 0  1  1  6  2  3  6  9 21 13 11 17 20 38 39 33 34 24 22 31 34 28 12  5  5  3  9  7  2  2  1  2  1  1  0
 0  1  2  6  2  2  6  4  6  2 12 36 52 77 83 66 56 56 61 66 63 49 33 23 12  1  2  3  5  3  2  1  1  1  1
 1  2  1  1  1  1  3  3  2  5 23 51 71 85 84 75 84100 94 74 64 55 41 27 14  5  2  1  2  4  2  1  1  0  1  1
 1  2  2  1  0  0  1  4  8 15 26 41 63 82 84 74 71 75 70 69 72 57 35 17  7  6  5  3  1  1  1  2  2  1  1
 1  1  1  1  1  1  2  4  7 11 14 21 37 60 78 77 64 52 49 62 62 40 22  9  2  3  5  4  2  1  1  1  1  0  0
 1  1  0  0  0  2  4  3  4  3  3  9 20 32 40 42 43 39 32 30 26 20 15  8  5  7  6  4  4  3  1  0  0  0  0  0
 1  0  1  1  0  2  3  2  3  1  2  5 11 18 23 21 23 17 16 15 13 12 10  9 12 11  8  6  6  4  1  1  1  0  1  1
 0  0  0  1  1  1  1  1  2  2  4  4  3  6 11 15 15 12 11 11  8  6  6  9 10  8  7  6  4  3  1  1  0  0  1  1
 0  1  0  1  1  1  1  1  1  1  3  3  2  2  4  6 11 16 11  5  3  3  5  7  7  5  3  1  1  1  1  1  0  0  0  0
 0  0  0  1  1  1  2  2  3  1  1  2  1  1  2  3  7 11  9  5  2  1  3  4  4  3  1  0  0  1  1  1  1  0  0  0
 0  0  0  1  2  2  2  2  1  1  1  1  1  2  2  3  3  3  4  4  2  1  2  2  2  2  1  1  1  1  1  1  1  0  0  0
 0  0  1  1  1  1  1  2  1  1  1  2  3  3  2  3  3  2  2  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  0  0
 0  1  1  0  0  0  1  1  2  2  1  2  3  2  1  1  1  2  2  2  2  1  1  0  0  1  1  1  0  0  0  1  1  1  1  0
 0  1  1  1  1  1  1  1  1  1  1  1  2  2  2  1  0  0  2  3  2  1  1  0  0  1  1  1  0  0  0  1  1  1  1  0
 0  1  1  2  1  1  1  1  0  0  1  1  1  1  1  1  0  0  0  1  2  1  1  0  0  0  1  1  1  0  1  1  1  1  1  0
10
10
```

FIGURE 48 B64

Intensity Distriubtion - Central 129 Microradians

Task 2.3A1 - Nominal + Mfg. Error + Second Temperature

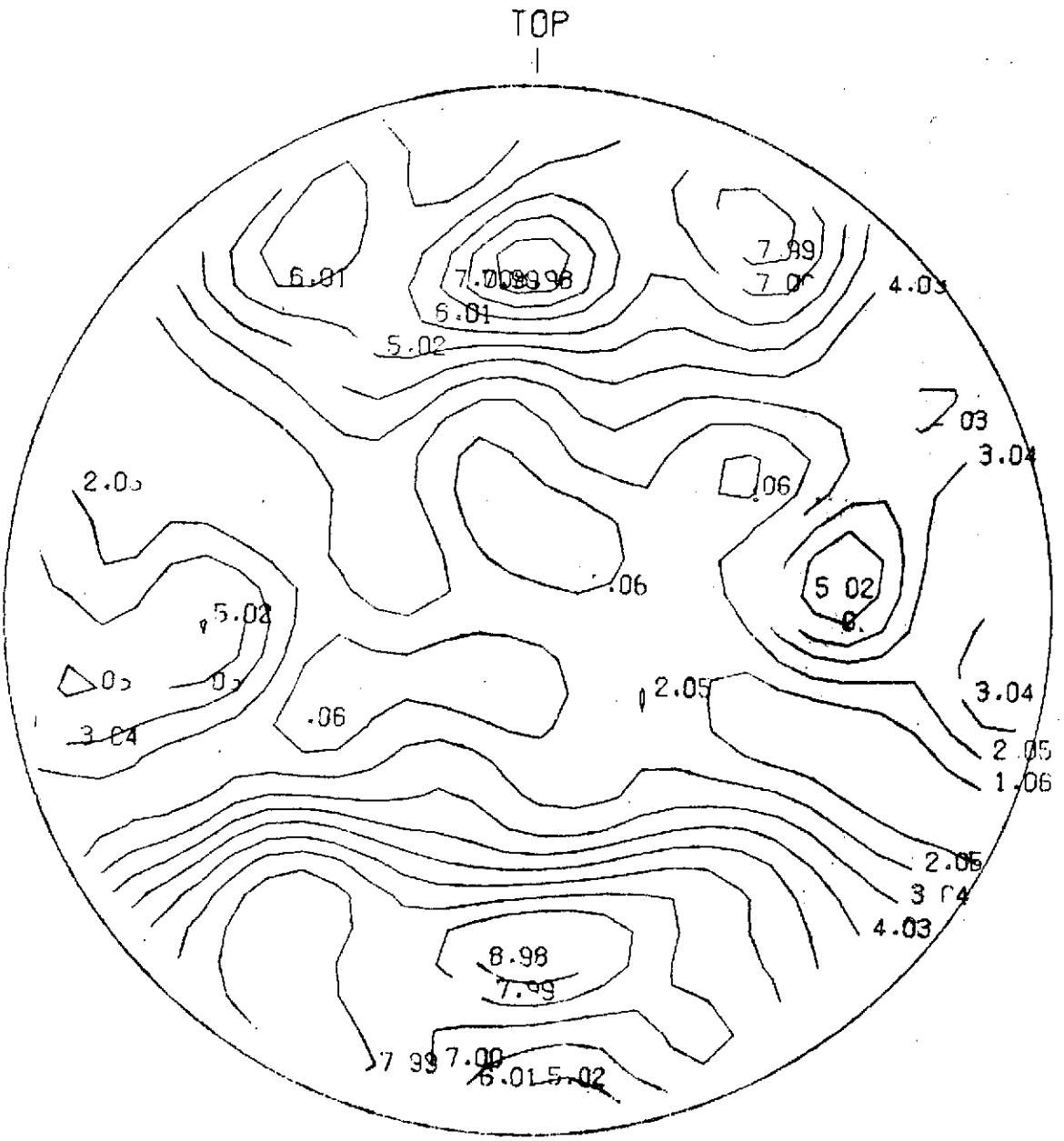


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FIGURE 49

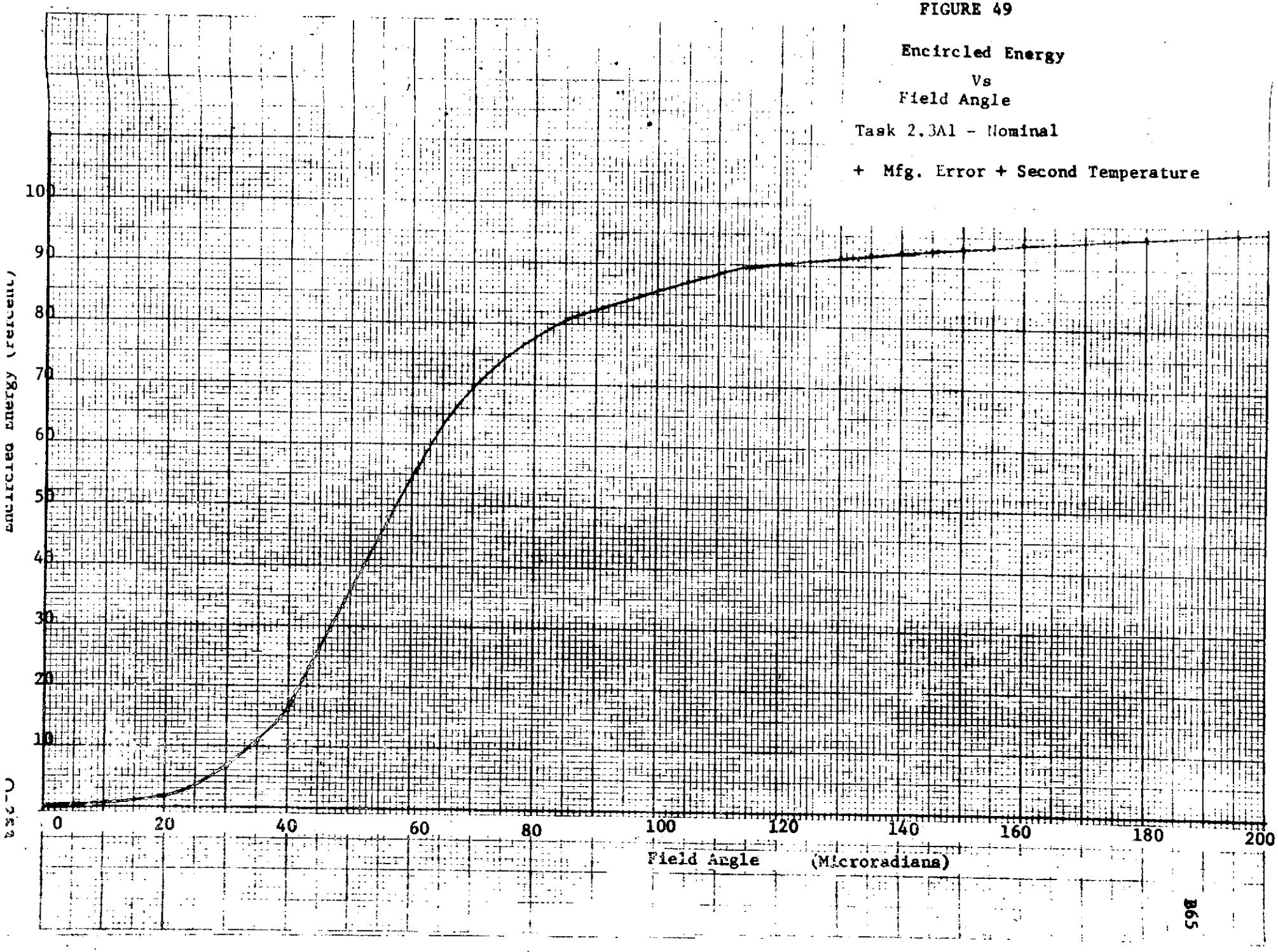
Encircled Energy

Vs

Field Angle

Task 2.3A1 - Nominal

\+ Mfg. Error + Second Temperature



B65

TABLE B16

ENCIRCLED ENERGY

Task 2.3A2 - Nominal + Mfg. Error + Third Temperature

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.00	0.1	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.1
6.00	0.1	0.1	0.1	0.3	0.2	0.2	0.1	0.1	0.1
8.00	0.4	0.3	0.2	0.4	0.2	0.3	0.2	0.3	0.4
10.00	0.6	0.4	0.3	0.6	0.4	0.5	0.4	0.4	0.5
12.00	1.2	1.0	0.6	0.8	0.5	0.7	0.7	0.9	1.0
14.00	1.2	1.0	1.0	1.1	0.8	1.1	1.1	0.9	1.0
16.00	1.9	1.8	1.4	1.4	1.0	1.3	1.5	1.7	1.6
18.00	2.2	2.0	2.0	1.7	1.9	1.7	1.9	2.0	2.0
20.00	2.9	2.9	2.8	2.3	1.9	2.3	2.8	2.9	2.7
22.00	3.3	3.2	3.5	2.9	3.0	2.9	3.4	3.3	3.2
24.00	4.4	4.5	4.3	3.5	3.6	3.6	4.2	4.6	4.4
26.00	5.0	5.1	5.3	4.4	4.8	4.5	5.1	5.4	5.2
28.00	6.9	7.2	7.0	5.8	5.1	5.9	7.1	7.4	7.1
30.00	8.0	8.4	8.0	7.1	6.9	7.1	8.2	8.8	8.5
32.00	10.6	11.2	9.8	8.5	7.7	8.5	10.2	11.7	11.1
34.00	11.2	11.8	11.5	10.7	9.8	10.6	12.2	12.4	11.7
36.00	14.0	14.9	13.6	12.4	11.6	12.3	14.7	15.7	14.7
38.00	15.5	16.4	15.7	14.9	15.1	14.8	16.9	17.4	16.4
40.00	18.3	19.4	18.3	17.1	16.7	16.9	19.7	20.6	19.4
42.00	19.7	20.7	21.2	20.6	21.5	20.5	22.7	22.0	20.8
44.00	23.1	24.1	23.7	22.8	23.7	22.5	25.4	25.8	24.5
46.00	25.6	26.5	26.9	27.2	28.8	26.9	28.6	28.3	27.1
48.00	29.3	30.1	30.9	30.8	30.1	30.5	32.6	32.1	30.9
50.00	32.4	33.0	33.3	34.1	35.2	33.8	35.1	35.1	34.0
52.00	36.6	37.0	37.3	37.7	37.9	37.4	38.8	39.1	38.1
54.00	38.9	39.3	40.2	41.6	42.6	41.4	42.0	41.3	40.3
56.00	43.1	43.5	44.8	45.5	45.6	45.3	46.4	45.3	44.4
58.00	46.3	46.6	47.4	48.4	50.5	48.2	49.2	48.3	47.5
60.00	49.7	50.1	51.4	52.0	53.8	52.0	52.9	51.6	50.9
62.00	52.2	52.5	54.6	55.9	57.8	55.8	56.0	53.8	53.2
64.00	56.4	56.6	57.5	58.4	60.8	58.4	58.8	57.5	57.4
66.00	58.8	59.0	60.9	62.4	64.5	62.3	61.8	59.8	59.8
68.00	62.4	62.4	63.8	64.7	66.2	64.7	64.3	63.1	63.2
70.00	64.5	64.5	66.3	67.6	69.1	67.6	66.7	65.0	65.2
72.00	67.7	67.5	68.7	69.6	71.4	69.6	68.9	67.9	68.3
74.00	69.4	69.0	71.1	72.0	73.5	72.0	71.2	69.3	69.8
76.00	72.2	71.6	73.4	73.7	75.0	73.8	73.3	71.8	72.4
78.00	73.9	73.2	74.6	75.2	76.7	75.2	74.7	73.4	74.0
80.00	75.8	75.0	76.5	76.7	77.8	76.7	76.6	75.1	75.9

TABLE B17

ENCIRCLED ENERGY

Task 2.3A2 - Nominal + Mfg. Error + Third Temperature

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.1
10.00	0.6	0.4	0.3	0.6	0.4	0.5	0.4	0.4	0.5
15.00	1.6	1.5	1.2	1.3	1.0	1.3	1.3	1.4	1.4
20.00	2.9	2.9	2.8	2.3	1.9	2.3	2.8	2.9	2.7
25.00	4.8	4.9	5.1	4.3	4.1	4.3	4.9	5.1	4.9
30.00	8.0	8.4	8.0	7.1	6.9	7.1	8.2	8.8	8.3
35.00	12.8	13.6	12.5	11.2	11.1	11.1	13.2	14.3	13.3
40.00	18.3	19.4	18.3	17.1	16.7	16.9	19.7	20.6	19.4
45.00	24.5	25.5	25.5	25.7	26.7	25.4	27.2	27.2	25.7
50.00	32.4	33.0	33.3	34.1	35.2	33.8	35.1	35.1	34.0
55.00	41.6	42.0	42.8	43.5	44.9	43.3	44.5	43.8	43.0
60.00	49.7	50.1	51.4	52.0	53.8	52.0	52.9	51.6	50.9
65.00	57.5	57.7	59.6	60.8	63.0	60.8	60.6	58.6	58.4
70.00	64.5	64.5	66.3	67.6	69.1	67.6	66.7	65.0	65.2
75.00	71.0	70.5	72.3	72.9	74.3	72.9	72.4	70.8	71.3
80.00	75.8	75.0	76.5	76.7	77.8	76.7	76.6	75.1	75.9
85.00	79.2	78.2	79.7	79.9	80.6	79.9	79.9	78.4	79.3
90.00	81.8	80.9	81.9	82.3	82.6	82.3	82.1	81.2	82.0
95.00	83.9	83.4	83.8	84.1	84.3	84.1	83.9	83.4	84.0
100.00	85.4	85.2	85.4	85.6	85.8	85.7	85.5	85.2	85.4
105.00	86.5	86.6	86.8	86.9	87.1	87.0	86.8	86.6	86.6
110.00	87.7	87.8	88.0	88.0	88.3	88.1	88.0	87.9	87.8
115.00	88.7	89.0	89.0	88.9	89.2	89.0	89.0	89.0	88.8
120.00	89.6	89.9	89.9	89.8	90.0	89.8	89.9	89.9	89.6
125.00	90.3	90.6	90.6	90.5	90.7	90.6	90.7	90.6	90.4
130.00	91.0	91.2	91.2	91.2	91.3	91.2	91.3	91.2	91.1
135.00	91.8	91.7	91.8	91.8	91.9	91.8	91.8	91.7	91.7
140.00	92.3	92.2	92.3	92.4	92.3	92.4	92.3	92.3	92.3
145.00	92.7	92.8	92.8	92.8	92.8	92.8	92.8	92.8	92.7
150.00	93.1	93.2	93.2	93.2	93.3	93.3	93.2	93.2	93.1
155.00	93.5	93.6	93.6	93.6	93.7	93.6	93.6	93.6	93.5
160.00	93.9	93.9	93.9	93.9	94.0	93.9	94.0	94.0	93.9
165.00	94.3	94.3	94.3	94.3	94.3	94.3	94.3	94.3	94.2
170.00	94.6	94.6	94.6	94.6	94.6	94.6	94.6	94.6	94.6
175.00	94.9	94.9	94.9	94.9	94.9	94.9	94.9	94.9	94.9
180.00	95.2	95.2	95.2	95.2	95.3	95.2	95.2	95.2	95.2
184.99	95.4	95.5	95.4	95.5	95.5	95.5	95.5	95.5	95.5
189.99	95.7	95.7	95.7	95.8	95.8	95.8	95.8	95.7	95.7
194.99	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0
199.99	96.2	96.2	96.2	96.2	96.2	96.2	96.2	96.2	96.2

FIGURE B50

Wavefront Map-(Polarization

Task 2.1A2 - Nominal + Mfg. Error + Third Temperature

MAP IN UNITS OF 0.01 WAVES

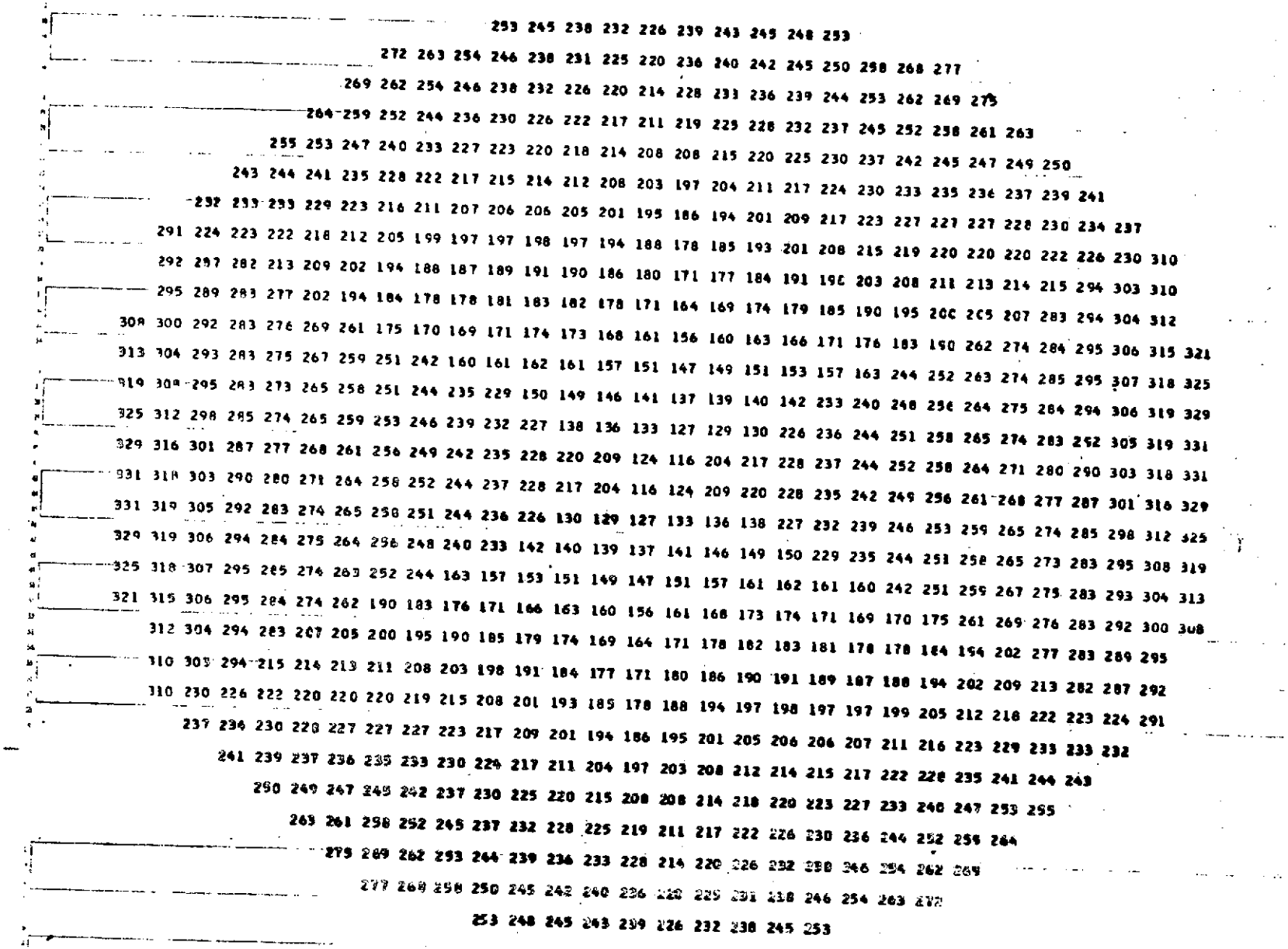


FIGURE B51

Wavefront Plot-Q Polarization

Task 2.3A2 - Nominal + Mfg. Error + Third Temperature

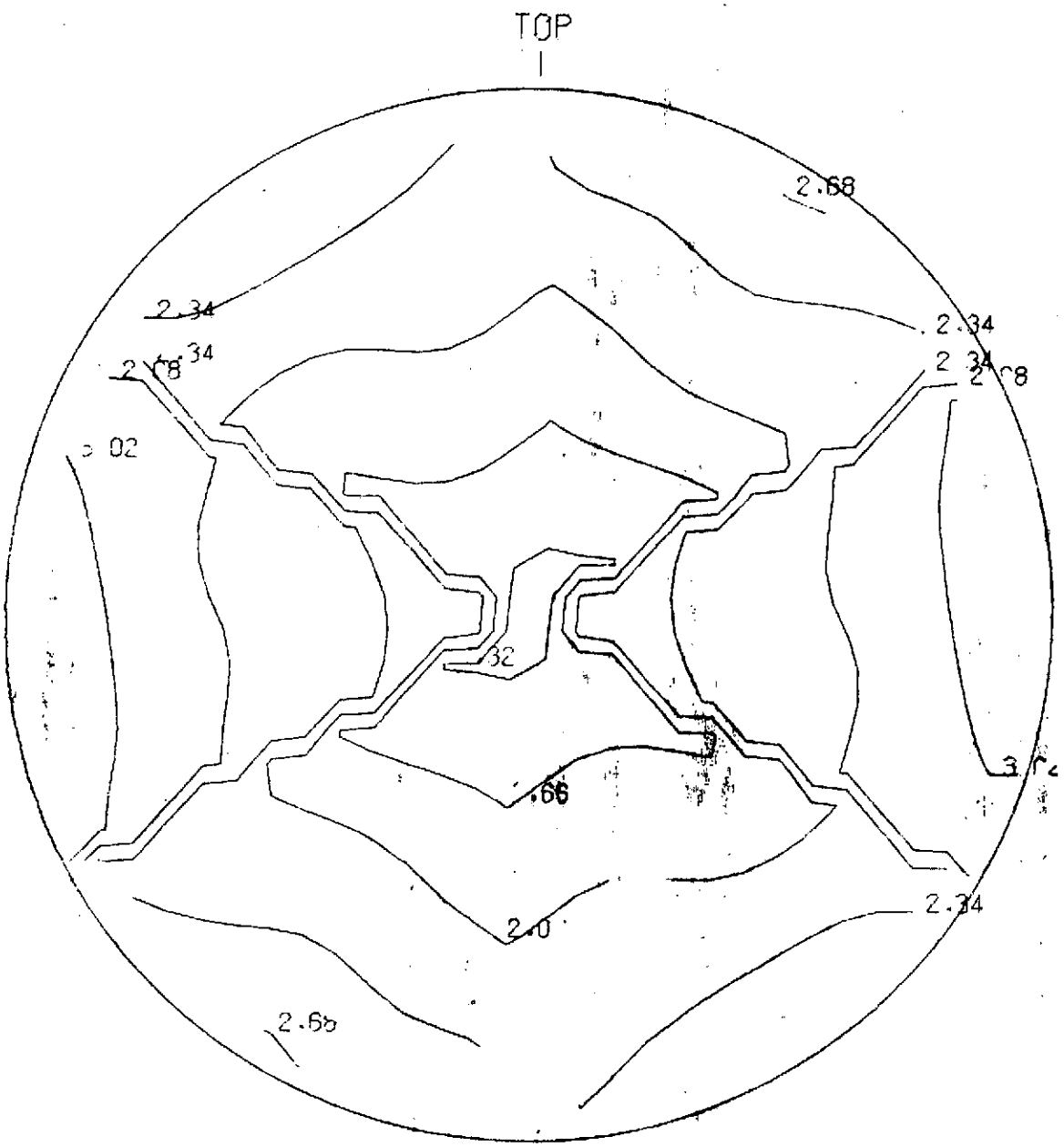


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FIGURE 853

Wavefront Map-P Polarisation
Task 2.1A2 - Nominal + Mfg. Error + Third Temperature
MAP IN UNITS OF 0.01 WAVES

362 353 346 340 335 198 201 204 206 212
380 372 363 354 347 340 334 328 194 199 201 203 208 217 227 236
378 370 362 354 347 340 334 329 322 187 192 194 197 203 211 220 228 233
373 367 360 352 345 338 334 330 325 320 177 183 187 190 196 203 211 216 220 221
364 361 356 349 341 335 331 329 326 322 317 167 174 178 183 189 195 200 204 206 207 209
352 352 350 343 336 330 326 324 322 320 317 311 156 162 169 176 182 188 192 193 194 195 198 200
340 341 341 338 332 325 319 316 315 314 313 310 304 145 152 160 168 175 182 185 185 185 186 189 192 196
356 332 332 331 327 321 316 308 305 306 306 306 302 297 137 144 151 159 167 173 177 179 179 181 185 189 226
358 352 348 322 318 310 303 297 295 297 300 299 295 289 129 136 143 150 156 162 166 170 172 172 173 210 219 226
361 359 349 343 310 302 292 286 286 289 292 291 287 280 122 127 132 138 143 148 154 159 164 166 199 210 220 228
374 368 358 349 342 335 327 284 278 278 280 282 281 277 270 114 118 121 125 129 135 141 148 178 190 200 211 222 231 237
379 370 359 349 341 333 325 317 308 268 269 270 269 266 259 105 108 110 112 116 122 160 168 179 190 201 211 223 234 241
385 376 361 349 339 331 324 317 310 301 295 258 257 255 250 96 98 99 100 149 156 164 172 180 191 200 210 222 235 245
391 378 364 351 340 331 325 319 312 305 298 293 247 245 241 86 88 89 142 152 160 167 174 181 190 199 208 221 235 247
395 382 367 353 343 334 327 322 315 308 301 294 286 275 233 74 120 133 143 153 160 168 174 180 187 196 206 219 234 247
397 384 369 356 346 337 330 324 318 310 303 293 283 270 86 245 125 136 144 151 158 165 172 177 184 193 203 217 232 245
395 385 372 360 350 341 330 322 314 306 299 112 110 109 107 262 266 269 270 145 151 160 167 174 181 189 199 211 224 235
391 384 373 361 351 340 329 318 310 133 127 123 121 119 117 271 277 281 282 281 280 158 167 175 183 191 199 209 220 229
387 381 372 361 350 340 328 160 153 146 141 136 133 130 126 281 288 293 294 292 289 290 295 177 185 192 199 208 216 224
378 370 360 349 177 175 170 165 160 155 149 144 139 134 291 298 303 304 301 298 298 304 314 322 193 199 205 211
376 369 360 189 184 183 181 178 173 168 161 154 147 141 300 307 311 312 309 307 309 314 322 329 333 198 202 208
376 200 196 192 190 190 190 189 185 178 171 163 155 148 308 314 317 318 318 317 320 325 332 338 342 344 344 206
207 204 200 198 197 197 197 193 187 179 171 164 156 316 321 325 326 326 328 331 337 343 349 353 353 352
202 209 207 206 205 203 200 196 187 181 174 167 323 329 332 334 336 337 342 348 355 361 364 364
220 219 217 215 212 207 200 195 190 185 178 329 334 338 340 343 347 353 360 368 373 376
233 231 228 222 215 207 202 198 195 189 331 337 342 346 350 356 364 372 379 384
245 239 232 223 215 209 206 203 198 334 340 346 352 358 366 374 382 389
247 238 228 220 215 212 210 206 340 346 352 359 366 375 383 392
223 218 215 213 209 347 352 358 365 373

Q-25

FIGURE B53

Wavefront Plot-P Polarization

Task 2.3A2 - Nominal + Mfg. Error + Third Temperature

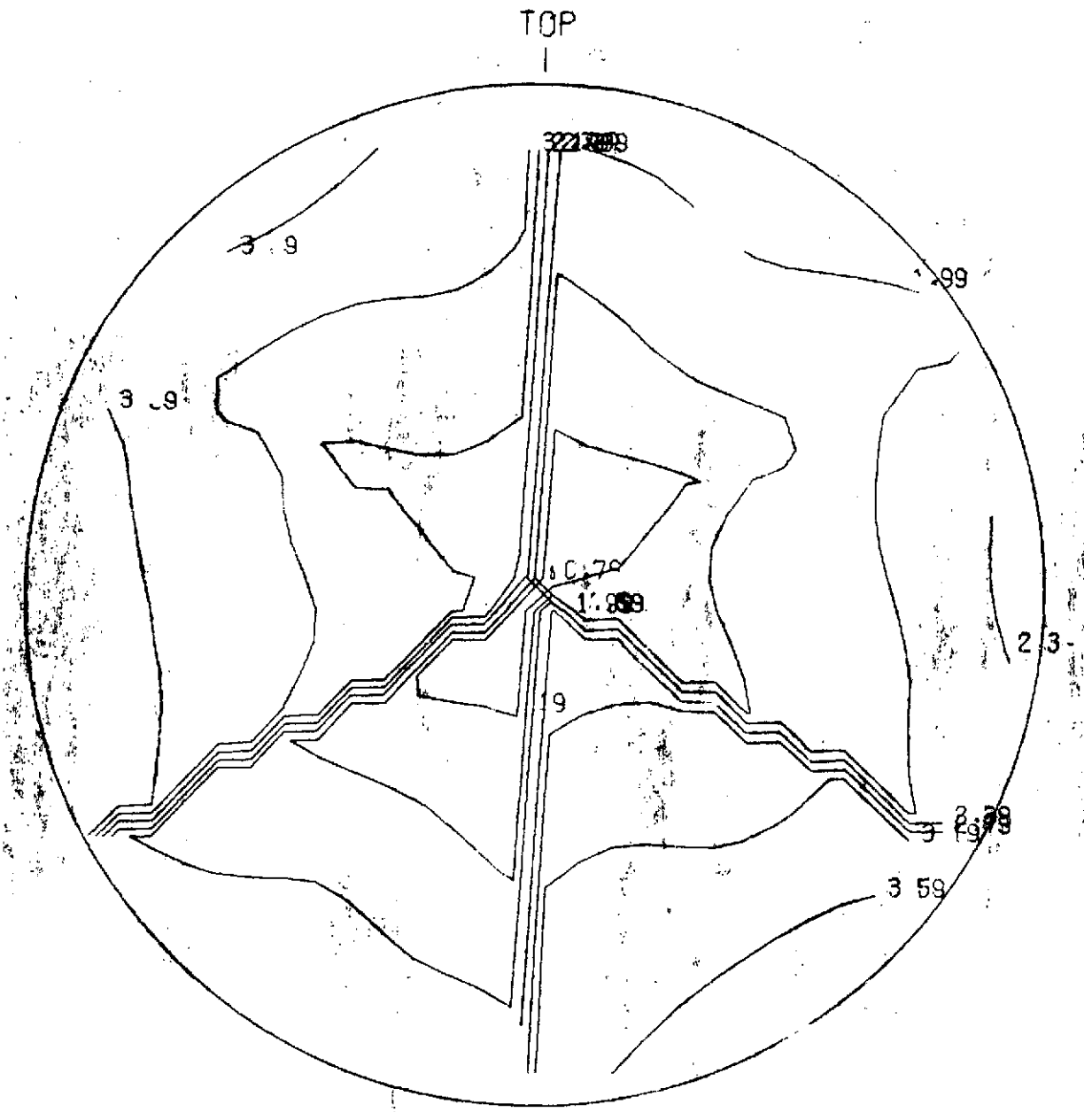

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FIGURE B54

Task 2.3A2 - Nominal + Mfg. Error + Third Temperature

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0189 = 100
TOTAL ENERGY = 0.2461000D+01
MAP REPRESENTS 0.2309204D+01 OR 93.8319 PERCENT OF TOTAL ENERGY

```
 1  1  1  1  1  0  1  2  1  0  1  1  2  2  1  1  0  0  0  0  1  2  1  1  1  1  1  1  1  0  1  1  1  1  1
 1  1  1  1  0  0  1  1  1  1  1  0  1  2  3  3  2  0  0  0  2  3  3  1  1  2  1  2  1  0  1  1  1  1  0
 0  1  1  0  0  0  1  1  1  1  1  0  0  1  0  2  3  2  1  1  2  1  3  4  2  1  2  1  1  0  1  1  1  1  0
 0  0  1  0  0  1  1  1  1  1  1  1  1  1  0  1  2  2  2  2  1  1  2  3  2  1  2  2  1  1  0  0  0  1  1
 0  0  0  0  1  0  1  1  1  2  2  2  2  2  2  4  4  3  3  2  2  3  3  2  1  1  1  1  1  2  1  1  0  0  0
 0  0  0  1  1  1  1  1  2  4  3  3  3  1  4  7 10 11  8  5  4  2  1  2  2  2  1  0  2  1  1  1  0  0  0
 0  0  1  1  1  1  1  2  5  6  4  5  4  2  4  5 13 19 11  5  6  2  1  2  1  1  2  1  1  1  1  1  0  0  0
 1  0  0  1  1  2  2  5  7  6  8  9  5  5  6  6 11 16 13 11 12  6  2  4  2  0  2  2  1  1  1  1  0  0  0
 1  0  1  1  1  1  3  4  5  8 10  7  6  9 12 18 19 20 27 27 26 21  9  5  2  1  3  2  1  1  0  1  1  1  0
 0  0  0  0  1  2  2  2  3  6  6  8 16 22 29 36 37 44 49 42 38 34 22 11  4  5  5  2  1  1  1  0  0  1  1
 0  0  0  1  2  3  2  2  1  1  5 18 21 28 52 49 42 58 61 59 58 45 33 21 12  9  5  1  2  1  1  1  1  1  1
 1  1  2  2  2  4  4  4  3  3 10 23 31 48 66 51 57 82 69 64 80 73 49 32 23 14  7  4  3  1  1  1  1  1  1
 1  2  2  1  2  4  5  5  4  6 11 19 41 65 65 57 80100 76 56 73 75 44 31 25 11  8  7  4  1  1  2  2  2  1
 1  1  1  1  3  4  3  5  5  7 15 17 27 42 48 52 51 51 54 44 52 54 32 36 30 13 12  5  5  4  4  4  1  1  1
 1  0  1  2  3  3  1  5  9  8 16 18 17 21 35 37 21 23 39 30 24 31 34 43 31 23 23  5  5  7  5  4  0  1  1
 0  0  1  2  2  3  2  5  9 13 17 17 15 10 24 26 10 14 23 22  9 16 34 33 23 22 22  8  5  5  4  4  2  1  0
 1  1  1  2  3  5  5  5  7 21 25 18 27 17 24 33 13  3  3 21 24 44 59 30 23 20 13 10  7  4  4  5  3  2  0
 1  1  1  3  4  5  5  6  7 20 29 29 55 39 20 27 18 16 13 20 22 50 60 28 28 20  6  6  5  5  4  3  2  1  1
 1  2  2  4  4  5  4  8 13 23 42 45 52 33  7 10  3  3 15 22 11 16 24 26 40 26  8  3  1  5  4  2  0  1  1
 1  1  1  4  3  4  4 10 24 26 36 33 20 13  7 21 25 15 18 23 13  5  3 12 27 20 14  6  1  2  1  2  1  0  1
 0  1  1  5  2  3  5  9 23 14 12 17 19 37 37 34 39 27 23 31 34 28 14  6  5  4 10  8  2  2  1  2  2  1  0
 0  1  2  4  2  2  6  5  7  2 14 37 55 84 83 62 54 53 56 61 62 54 38 28 15  1  2  3  3  5  3  2  1  1  1
 1  2  1  1  1  1  3  3  2  6 28 53 72 88 84 73 83100 92 72 65 58 44 30 18  6  2  1  2  4  2  1  1  1  1
 1  2  2  1  0  0  2  4  9 19 32 44 60 73 75 72 75 82 76 71 69 53 34 18 10  7  6  3  1  1  1  2  2  1  1
 1  1  1  1  1  1  3  4  9 16 18 23 36 56 72 75 68 58 53 63 61 40 22 10  3  3  4  3  1  1  1  2  1  0  0
 1  1  0  0  1  2  3  3  5  5  3  7 18 33 42 45 48 44 34 31 29 22 15  8  5  7  6  4  3  3  1  0  0  0  0
 1  1  1  0  1  2  2  2  3  1  1  4  9 17 21 24 24 21 19 16 13 10  8  9 12 11  9  7  6  4  1  1  0  0  1
 0  0  1  1  1  1  1  1  2  1  3  4  3  5 12 17 18 16 15 82  8  5  4  7  8  7  7  5  3  2  1  0  0  1  0
 0  0  0  1  1  0  1  1  1  2  2  1  2  4  7 13 19 14  6  3  3  4  6  9  4  3  2  1  2  2  1  0  0  0  0
 0  0  0  1  1  1  2  2  1  1  1  1  1  2  4  7 11  9  5  2  1  2  3  3  2  1  0  0  1  1  1  0  0  0  0
 0  0  1  1  2  2  3  2  2  1  1  1  1  2  3  3  3  4  4  2  1  1  2  2  1  1  1  1  1  1  1  0  0  0  0
 0  1  1  0  0  1  1  1  2  2  1  1  1  3  4  3  2  2  2  2  1  1  1  1  2  1  1  1  1  1  1  1  0  0  0
 0  1  1  1  1  1  1  1  1  2  2  1  2  3  3  1  1  1  1  2  2  2  1  1  0  1  1  1  1  1  1  1  1  0  0
 0  1  1  2  1  1  1  1  0  1  1  1  2  2  2  1  1  0  0  2  3  2  1  1  0  1  1  1  1  0  0  1  1  1  1
TO
TO
```

FIGURE B55

Intensity Distriubtion - Central 129 Microradians

Task 2.3A2 - Nominal + Mfg. Error + Third Temperature

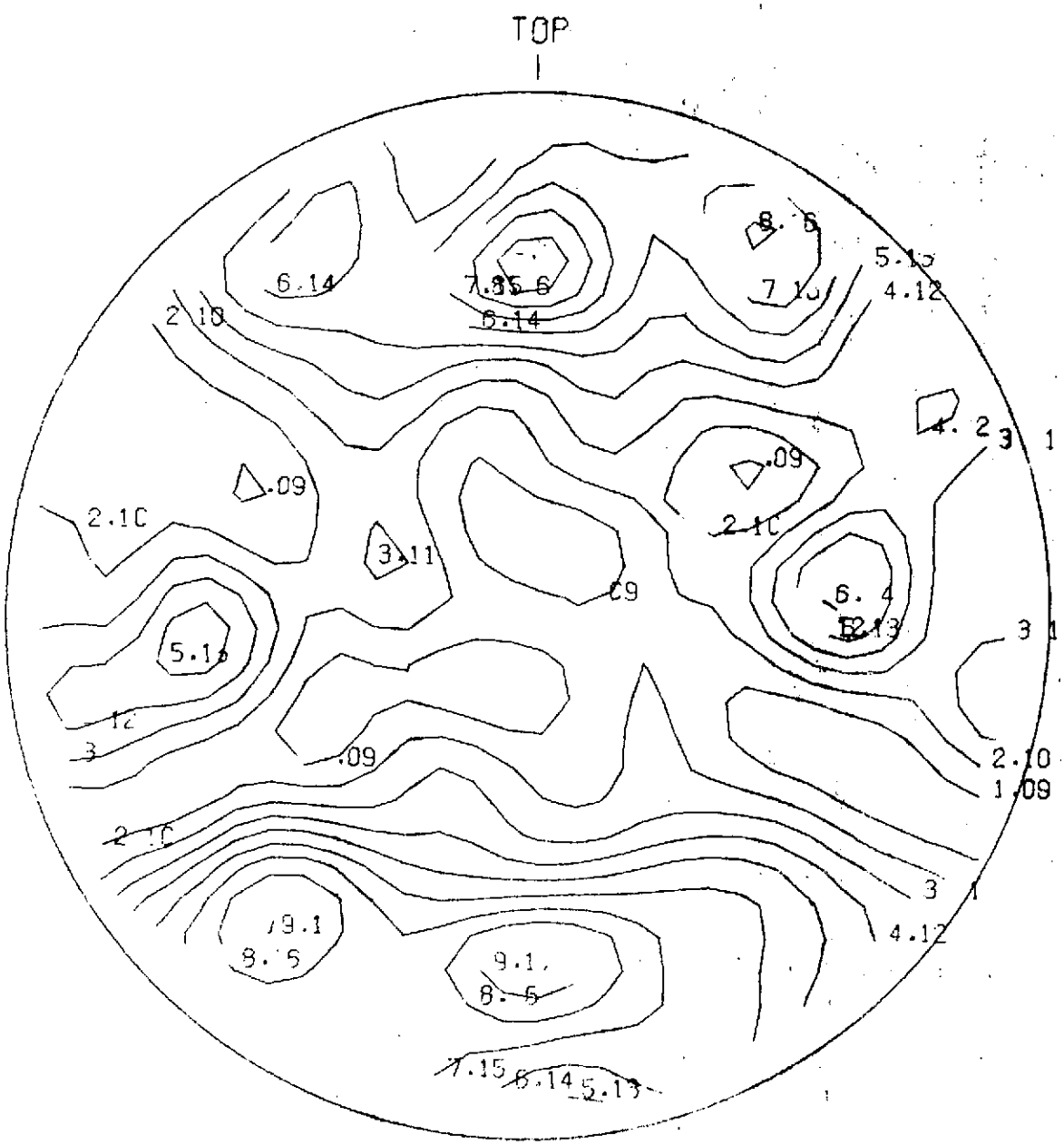

FIGURE B56

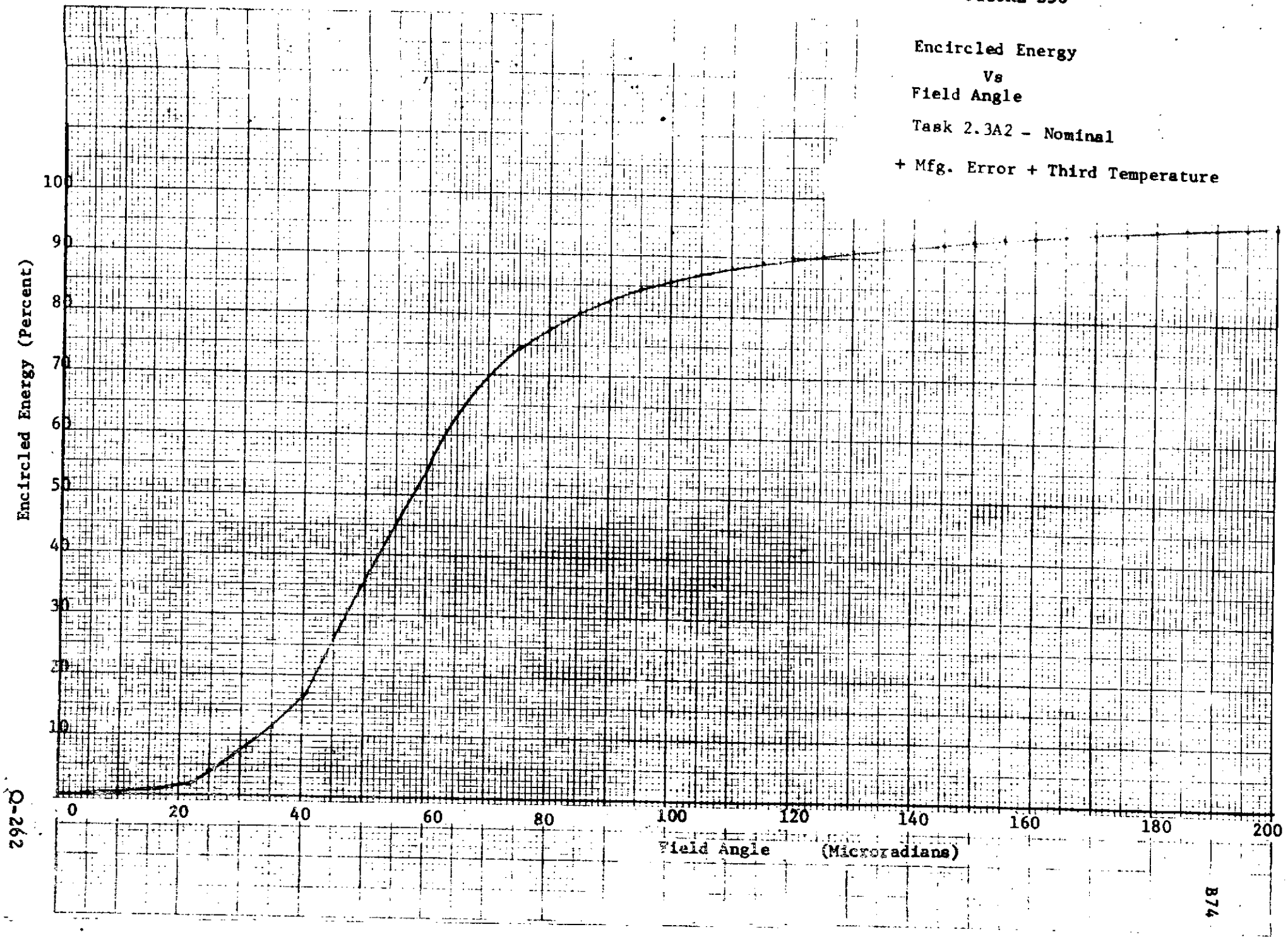
Encircled Energy
Vs
Field Angle
Task 2.3A2 - Nominal
+ Mfg. Error + Third Temperature
Encircled Energy (Percent)
100
90
80
70
60
50
40
30
20
10
0
20
40
60
80
100
120
140
160
180
200
Field Angle (Microradians)

TABLE B18

ENCIRCLED ENERGY

Task 2.5A - Nominal + Mfg. Error + Axial Gradient

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.0
4.00	0.2	0.2	0.1	0.1	0.0	0.0	0.1	0.3	0.3
6.00	0.2	0.2	0.5	0.4	0.2	0.2	0.6	0.3	0.3
8.00	0.9	0.9	0.9	0.6	0.2	0.3	1.0	1.1	0.9
10.00	1.2	1.3	1.4	0.9	0.6	0.6	1.6	1.6	1.3
12.00	2.8	2.9	2.3	1.4	0.7	1.0	2.6	3.3	2.8
14.00	2.8	2.9	3.3	2.4	1.5	2.0	3.8	3.3	2.8
16.00	4.7	5.0	4.5	3.0	2.1	2.7	5.1	5.5	4.6
18.00	5.6	5.8	5.7	4.4	5.0	4.1	6.4	6.4	5.6
20.00	7.4	7.8	7.7	5.7	5.0	5.6	8.5	8.5	7.5
22.00	8.2	8.6	9.4	7.9	9.0	7.9	10.1	9.4	8.5
24.00	10.6	11.2	11.1	9.2	10.5	9.3	11.8	12.1	11.1
26.00	11.8	12.4	13.2	12.1	14.5	12.3	13.8	13.5	12.7
28.00	15.0	16.0	16.5	15.3	15.5	15.5	17.6	17.1	16.1
30.00	17.1	18.1	18.6	18.3	19.6	18.5	19.4	19.7	18.7
32.00	21.6	22.9	22.0	20.9	21.4	21.1	23.2	24.5	23.2
34.00	22.5	24.0	24.6	25.0	24.8	25.1	26.2	25.6	24.2
36.00	27.4	29.0	28.4	27.8	27.9	27.8	30.5	30.6	29.0
38.00	29.5	31.2	31.3	31.5	32.8	31.5	33.3	33.1	31.4
40.00	33.7	35.2	34.9	34.6	35.1	34.5	37.4	37.1	35.6
42.00	35.6	37.2	38.5	39.2	41.2	39.1	40.9	39.1	37.5
44.00	40.0	41.1	41.6	41.6	43.9	41.2	44.1	43.1	42.0
46.00	42.9	43.6	45.0	46.7	49.9	46.4	47.3	45.7	44.9
48.00	47.0	47.3	49.2	50.4	51.2	50.0	51.2	49.4	48.8
50.00	50.1	50.2	51.6	53.6	56.2	53.3	53.2	52.2	51.9
52.00	54.2	53.7	55.5	57.0	58.4	56.7	56.8	55.5	55.7
54.00	56.4	55.9	58.1	60.2	61.9	60.1	59.2	57.6	57.6
56.00	60.3	59.6	62.2	63.3	64.1	63.3	62.8	60.9	61.2
58.00	63.0	62.3	64.0	65.4	67.3	65.3	64.8	63.3	63.5
60.00	65.7	65.0	67.2	67.9	69.4	67.9	67.6	65.8	66.2
62.00	67.6	66.9	69.0	70.2	71.8	70.2	69.6	67.5	67.9
64.00	70.3	69.7	71.1	71.6	73.4	71.7	71.6	70.0	70.6
66.00	71.9	71.4	73.0	73.8	75.5	73.8	73.4	71.6	72.2
68.00	74.0	73.4	74.7	75.1	76.3	75.1	75.0	73.6	74.3
70.00	75.1	74.6	76.1	76.7	77.8	76.6	76.3	74.8	75.5
72.00	77.0	76.4	77.4	77.7	78.7	77.7	77.5	76.5	77.3
74.00	77.9	77.2	78.6	79.0	79.7	79.0	78.6	77.3	78.1
76.00	79.4	78.7	79.8	79.9	80.3	79.9	79.7	78.8	79.5
78.00	80.3	79.6	80.4	80.7	81.1	80.6	80.4	79.7	80.3
80.00	81.4	80.6	81.4	81.4	81.7	81.4	81.4	80.7	81.4

TABLE B19

ENCIRCLED ENERGY

Task 2.5A - Nominal + Mfg. Error + Axial Gradient

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.2	0.2	0.4	0.3	0.1	0.1	0.4	0.3	0.3
10.00	1.2	1.3	1.4	0.9	0.6	0.6	1.6	1.6	1.3
15.00	3.9	4.2	4.1	2.6	2.1	2.3	4.7	4.6	3.8
20.00	7.4	7.8	7.7	5.7	5.0	5.6	8.5	8.5	7.5
25.00	11.3	12.0	12.6	11.8	12.4	12.0	13.2	13.0	12.1
30.00	17.1	18.1	18.6	18.3	19.6	18.5	19.4	19.7	19.7
35.00	25.6	27.0	26.6	25.8	27.1	25.8	28.2	28.4	27.1
40.00	33.7	35.2	34.9	34.6	35.1	34.5	37.4	37.1	35.6
45.00	41.6	42.6	43.4	45.0	47.5	44.7	45.9	44.7	43.5
50.00	50.1	50.2	51.6	53.6	56.2	53.3	53.2	52.2	51.9
55.00	59.0	58.2	60.6	61.8	63.7	61.7	61.4	59.6	59.9
60.00	65.7	65.0	67.2	67.9	69.4	67.9	67.6	65.8	66.2
65.00	71.0	70.4	72.3	73.0	74.7	73.0	72.7	70.8	71.3
70.00	75.1	74.6	76.1	76.7	77.8	76.6	76.3	74.8	75.5
75.00	78.7	78.1	79.2	79.5	80.0	79.5	79.3	78.2	78.9
80.00	81.4	80.6	81.4	81.4	81.7	81.4	81.4	80.7	81.4
85.00	83.1	82.5	83.1	83.2	83.3	83.2	83.3	82.6	83.2
90.00	84.5	84.2	84.6	84.8	84.8	84.8	84.8	84.4	84.7
95.00	85.9	85.9	85.9	86.1	86.4	86.2	86.1	86.0	86.1
100.00	87.0	87.3	87.3	87.4	87.8	87.5	87.4	87.2	87.1
105.00	88.0	88.3	88.5	88.5	88.8	88.6	88.5	88.3	88.1
110.00	89.1	89.3	89.4	89.4	89.6	89.4	89.4	89.3	89.1
115.00	90.0	90.1	90.1	90.1	90.2	90.1	90.1	90.1	90.0
120.00	90.6	90.7	90.7	90.8	90.8	90.7	90.8	90.8	90.7
125.00	91.2	91.2	91.3	91.3	91.4	91.3	91.4	91.3	91.3
130.00	91.8	91.7	91.8	91.9	92.0	91.9	91.9	91.8	91.9
135.00	92.3	92.3	92.3	92.3	92.5	92.3	92.3	92.3	92.2
140.00	92.7	92.7	92.8	92.8	92.8	92.8	92.8	92.8	92.7
145.00	93.1	93.1	93.1	93.2	93.2	93.2	93.2	93.1	93.1
150.00	93.4	93.4	93.5	93.5	93.5	93.5	93.5	93.5	93.4
155.00	93.8	93.8	93.8	93.8	93.8	93.8	93.8	93.8	93.8
160.00	94.2	94.1	94.1	94.1	94.1	94.1	94.0	94.1	94.1
165.00	94.4	94.4	94.5	94.4	94.4	94.4	94.4	94.4	94.4
170.00	94.7	94.7	94.8	94.7	94.8	94.7	94.8	94.7	94.7
175.00	95.0	95.0	95.0	95.0	95.0	95.0	95.1	95.0	95.0
180.00	95.2	95.2	95.3	95.3	95.4	95.3	95.3	95.3	95.3
184.99	95.5	95.5	95.5	95.6	95.6	95.6	95.5	95.6	95.6
189.99	95.7	95.8	95.8	95.8	95.8	95.8	95.8	95.8	95.8
194.99	96.0	96.0	96.0	96.0	96.1	96.0	96.0	96.0	96.0
199.99	96.2	96.3	96.2	96.2	96.2	96.2	96.2	96.2	96.3

Wavefront Map-0 Polarization

Task 2.5A - Nominal + Mfg. Error + Axial Gradient

877

MAP IN UNITS OF 0.01 WAVES

159 153 148 143 139 152 155 156 156 159

173 167 161 155 149 144 140 134 151 154 155 156 159 165 172 179

172 167 162 156 150 146 142 137 132 146 150 152 153 157 163 170 175 178

170 166 161 155 150 145 142 139 135 130 138 143 146 148 153 158 164 167 169 169

163 162 158 153 148 143 140 139 137 134 128 128 135 139 143 148 153 156 158 158 158 158

153 155 154 150 144 139 135 134 134 134 131 126 120 127 132 138 143 148 150 151 150 150 150 151

142 149 147 145 140 134 130 128 128 130 130 127 121 112 120 127 133 139 143 145 145 144 144 144 146 148

200 136 138 138 136 131 125 121 120 123 125 125 122 116 106 113 120 128 134 138 140 139 139 138 139 140 142 219

203 200 197 131 128 122 116 112 113 117 120 120 116 110 101 107 113 120 126 130 132 133 133 133 133 210 216 221

207 203 200 195 121 114 107 104 106 110 113 113 109 102 95 100 104 109 114 118 121 124 126 127 202 211 218 223

216 211 206 201 195 189 183 100 97 98 101 104 104 100 94 88 92 94 97 101 105 110 115 185 194 203 212 220 226 229

221 215 208 201 194 188 183 177 170 90 92 94 94 91 85 81 83 84 85 88 93 172 179 187 195 203 213 222 229 233

226 219 210 200 192 187 184 179 173 166 161 83 83 81 76 72 74 74 75 165 171 177 183 190 196 203 212 221 230 235

231 223 212 202 193 188 185 181 176 170 165 161 73 72 69 63 65 65 160 168 175 181 187 192 196 202 209 219 229 237

234 226 215 204 196 191 188 185 179 173 168 162 155 145 61 52 140 152 162 169 175 182 187 191 194 199 207 218 228 237

237 228 218 207 199 194 191 187 182 175 169 162 152 140 52 61 145 155 162 168 173 179 185 188 191 196 204 215 226 234

237 229 219 209 202 196 192 187 181 175 168 160 65 65 63 69 72 73 161 165 170 176 181 185 188 193 202 212 223 231

235 230 221 212 203 196 190 183 177 171 165 75 74 74 72 76 81 83 83 161 166 173 179 184 187 192 200 210 219 226

233 229 222 213 203 195 187 179 172 93 88 85 84 83 81 85 91 94 94 92 90 170 177 183 188 194 201 208 215 221

229 226 220 212 203 194 185 115 110 105 101 97 94 92 88 94 100 104 104 101 98 97 100 183 189 195 201 206 211 216

223 218 211 202 127 126 124 121 118 114 109 104 100 95 102 109 113 113 110 106 104 107 114 121 195 200 203 207

221 216 210 133 133 133 133 132 130 126 120 113 107 101 110 116 120 120 117 113 112 116 122 128 131 197 200 203

219 142 140 139 138 139 139 140 138 134 128 120 113 106 116 122 125 125 123 120 121 125 131 136 138 138 136 200

148 146 144 144 144 145 145 143 139 133 127 120 112 121 127 130 130 128 128 130 134 140 145 147 145 142

151 150 150 150 151 150 148 143 138 132 127 120 126 131 134 134 134 135 139 144 150 154 155 153

152 150 150 150 156 153 148 143 139 135 128 128 134 137 139 140 143 148 153 158 162 163

169 169 167 164 158 153 148 146 143 138 130 135 139 142 145 150 155 161 166 170

178 175 170 163 157 153 152 150 146 132 137 142 146 150 156 162 167 172

179 172 165 159 156 155 154 151 136 140 144 149 155 161 167 173

159 156 153 155 152 137 140 148 151 159

Q-265

FD G - LA I AV AGE AG V_RAGE . AL GR

ON. MS C . C PK-PK 1.84 RED WAVEFRONT

FIGURE B58

Wavefront Plot-Q Polarization

Task 2.5A - Nominal + Mfg. Error + Axial Gradient

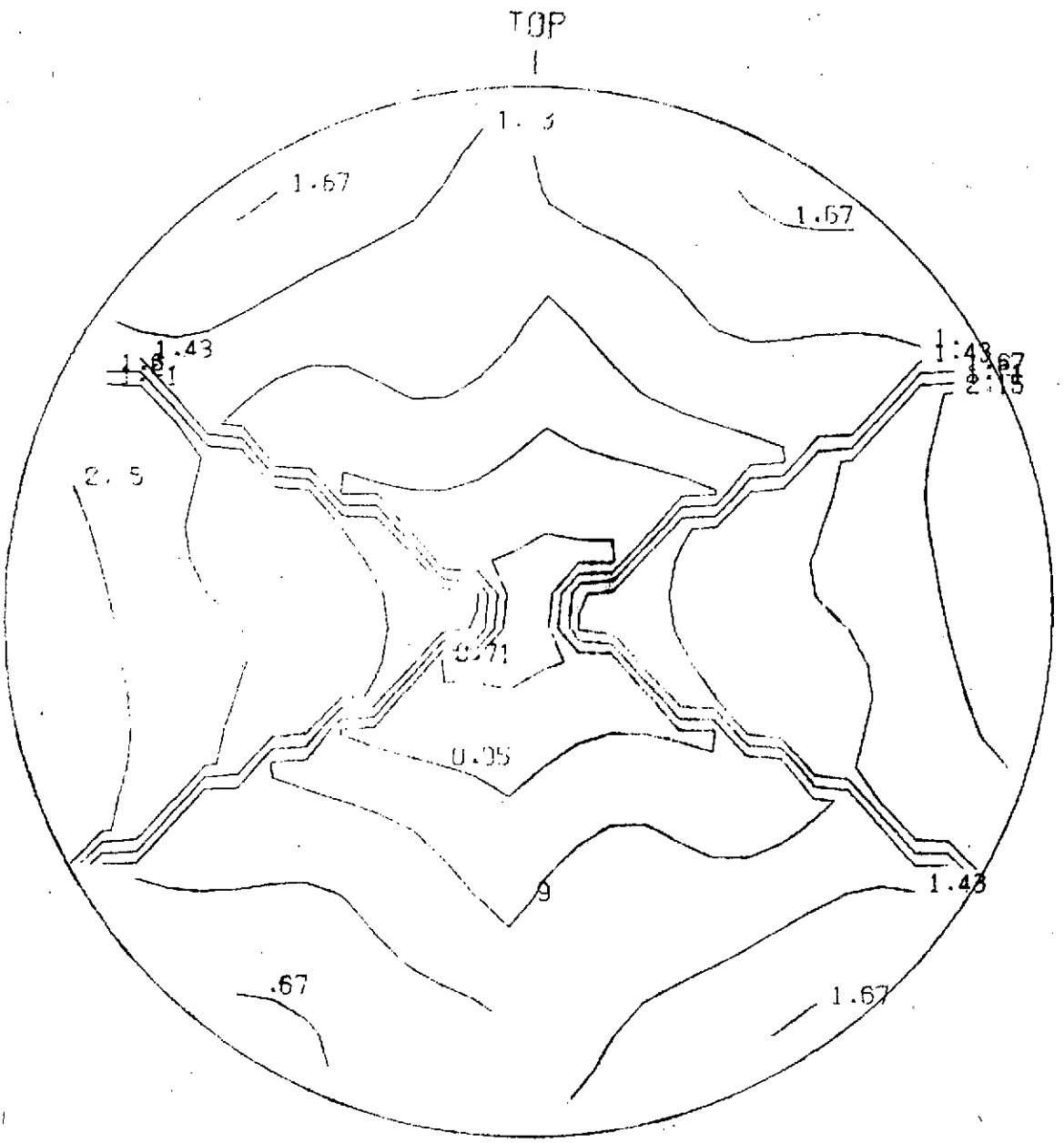

FIGURE B59

Wavefront Map-P Polarization

Task 2.5A - Nominal + Mfg. Error + Axial Gradient

MAP IN UNITS OF .0.01 WAVES

879

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                                  268 262 256 252 247 110 113 114 115 118
                              282 276 269 263 258 253 248 243 109 113 114 114 117 123 131 138
                          281 276 270 264 259 254 250 246 240 105 109 110 112 115 121 128 133 137
                      278 274 269 264 258 254 251 248 244 239  96 102 105 107 111 117 122 126 127 127
                  272 271 267 262 256 251 248 247 245 242 237  87  93  98 102 106 111 115 117 117 117 117
              262 264 262 258 253 247 244 243 243 242 239 234  78  85  91  96 101 106 109 109 109 108 109 110
          251 253 255 254 249 243 238 236 237 239 238 235 230  71  78  85  92  98 102 104 103 102 102 103 104 106
      266 244 246 247 244 239 233 229 229 231 234 234 230 225  65  72  79  86  92  97  98  98  97  97  97  99 101 135
  268 266 263 240 236 230 224 221 222 225 229 228 224 218  59  65  72  79  84  88  90  91  91  91  91 125 132 137
272 269 266 261 230 223 216 213 214 218 222 221 217 211  53  58  63  68  72  76  80  82  84  85 118 127 134 139
282 277 272 266 261 255 249 209 205 206 210 213 213 209 202  47  50  53  56  59  64  68  73 101 110 119 128 136 142 145
287 281 274 267 260 254 249 243 236 198 200 202 202 199 193  39  41  43  44  47  52  88  95 103 111 119 129 138 145 149
292 285 276 266 258 253 250 245 239 232 227 191 191 189 185  31  33  33  33  81  87  93  99 106 112 119 127 137 145 151
297 289 278 268 259 254 251 247 242 236 231 227 181 180 177  22  23  23  76  84  91  97 103 108 112 118 125 135 145 153
300 292 281 270 262 257 254 251 245 239 234 228 221 211 169  11  56  68  77  85  91  98 103 107 110 115 123 133 144 153
303 294 283 273 265 260 257 253 248 241 235 227 218 206  22 181  61  71  78  84  89  95 101 104 107 112 120 131 142 150
303 295 285 275 268 262 258 253 247 241 234 226  35  35  33 189 192 193  77  81  86  92  97 101 104 109 118 128 139 147
301 295 287 277 269 262 256 249 243 237 231  45  44  44  43 197 201 203 203  77  82  89  95 100 103 108 116 126 135 142
299 295 288 279 269 261 253 245 238  63  58  55  54  53  51 205 211 214 214 212 210  86  93  99 104 110 117 124 131 137
295 292 286 278 269 260 251  85  80  75  71  67  64  62  59 214 221 225 225 222 218 217 221  99 105 111 116 122 127 132
289 284 277 268  97  96  94  91  88  84  79  74  70  65 223 229 233 234 230 226 224 228 234 242 111 116 119 122
287 282 275 103 103 103 103 102 100  96  90  83  77  71 230 236 240 240 237 233 233 236 242 248 252 113 116 118
285 112 110 109 108 109 110 110 108 104  98  91  83  76 236 242 245 245 243 241 241 245 251 256 255 258 256 116
118 116 114 114 114 115 115 114 109 103  97  90  82 242 247 250 250 249 248 250 254 260 265 267 265 262
121 120 120 120 121 120 118 113 108 103  97  90 246 251 254 255 255 255 259 264 270 274 275 273
128 128 128 128 126 123 118 113 109 105  98 248 254 257 259 260 269 268 273 275 283 284
139 139 137 134 128 123 119 116 113 108 250 256 260 263 266 270 276 281 286 290
148 145 140 133 127 123 122 120 116 252 257 262 266 271 274 282 288 293
149 142 135 129 126 125 124 121 255 260 265 270 275 281 287 294
129 126 126 125 122 259 264 268 273 279
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FIGURE B60

Wavefront Plot-P Polarization

Task 2.5A - Nominal + Mfg. Error + Axial Gradient

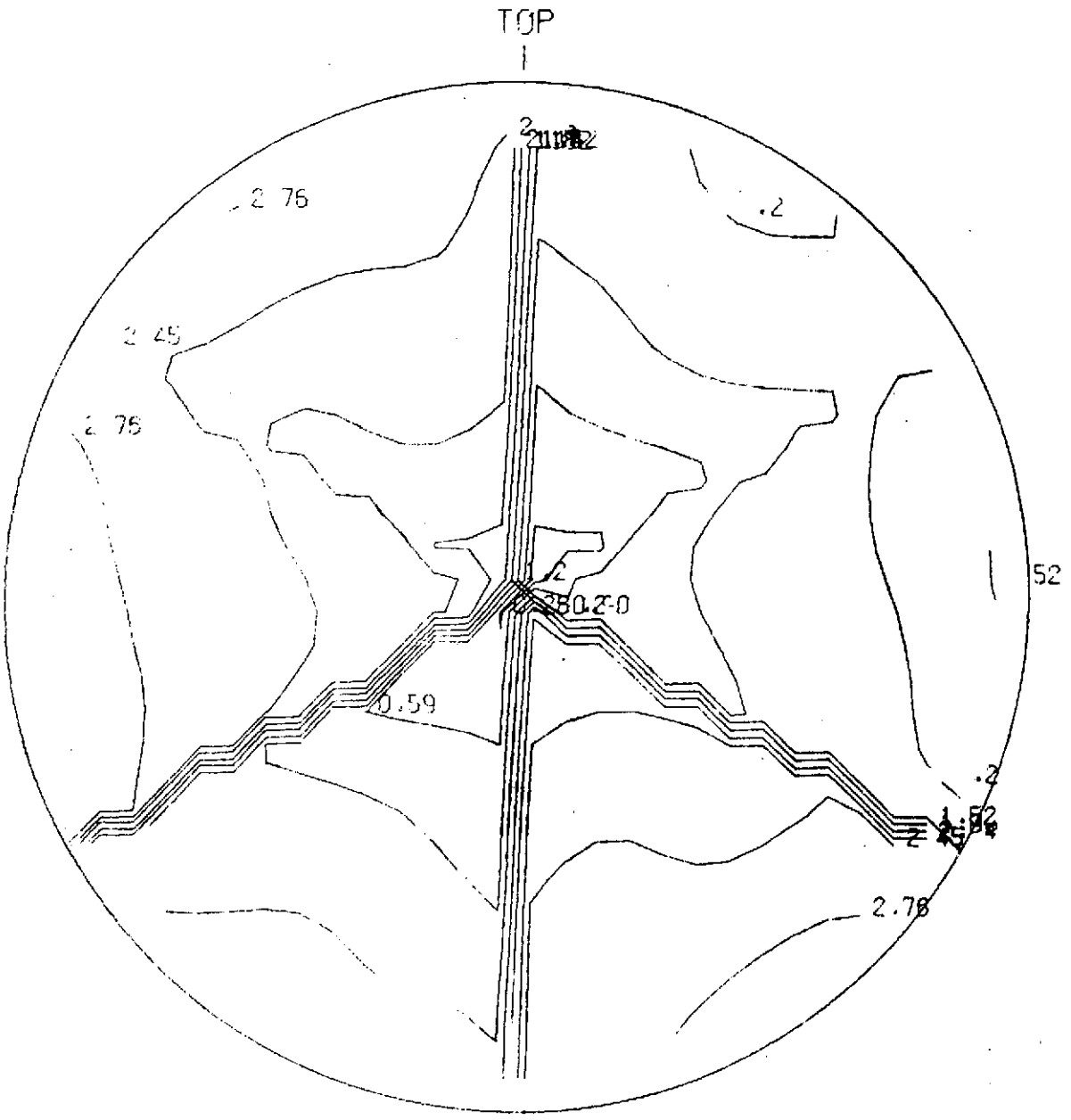


FIGURE B61

Task 2.5A - Nominal + Mfg. Error + Axial Gradient

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0285 = 100
TOTAL ENERGY = 0.24610000+01
MAP REPRESENTS 0.2314565D+01 OR 94.0498 PERCENT OF TOTAL ENERGY

```
 0  0  1  1  1  1  0  1  0  0  1  1  1  1  1  1  0  0  0  0  0  1  1  1  1  1  1  0  0  0  0  0  1  1  1  0  0
 0  0  1  1  1  1  0  0  1  0  1  1  1  1  1  1  1  1  0  0  1  1  1  1  1  1  1  0  0  0  0  0  1  1  1  0  0
 0  0  0  1  1  1  0  0  1  0  1  0  0  1  1  1  1  1  1  0  0  0  0  1  2  1  1  1  0  0  0  0  1  1  0  0  0
 0  0  0  0  0  0  0  0  1  1  1  1  0  0  1  1  1  1  1  1  0  0  0  1  2  2  1  1  1  1  0  0  1  1  0  0  0
 0  0  0  0  0  0  0  1  1  1  1  1  0  0  1  1  1  2  3  3  1  1  1  2  3  3  2  1  1  1  1  1  1  1  0  0  0
 0  0  0  1  1  0  1  1  1  2  1  1  1  1  2  3  5  5  3  2  1  2  2  1  1  1  1  1  1  1  0  0  0  0  0  0  0
 0  0  0  0  1  1  1  1  0  1  2  2  3  3  2  2  2  3  5  2  2  3  2  3  2  1  1  0  1  2  1  0  0  0  0  0  0
 1  0  0  0  0  0  1  1  1  1  2  5  6  4  3  4  5  4  3  5  7  5  3  2  3  2  1  1  1  1  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  1  2  2  5  7  4  3  3  3  7 10 11 13  9  7  5  1  1  1  1  2  2  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  1  0  1  4  6  5  4  5  4  5  9 15 21 19 11  8  6  2  1  0  2  3  1  0  0  0  1  0  0  0  0
 0  0  0  0  0  0  1  1  2  3  2  2  7  4  4 16 15 18 31 28 26 25 14  6  3  2  4  3  1  0  0  1  1  0  0  0  0
 0  1  1  0  1  1  2  3  3  1  1  7 11 18 25 23 43 65 53 39 40 34 19  9  7  4  2  2  1  0  0  1  1  1  0  0  0
 1  0  0  0  1  2  2  3  3  3  2  5 20 29 27 38 64 82 74 50 42 40 22 12 11  4  2  2  1  2  1  1  0  1  1  0  0
 1  0  1  1  2  2  1  3  3  6 10  8 15 25 35 44 47 63 80 61 48 47 26 19 16  7  6  1  2  3  3  2  1  1  1  0  0
 0  1  1  2  2  2  2  3  2  3  9 10 11 21 38 38 46 89 96 50 28 35 29 23 14  9 10  3  3  4  2  2  1  1  1  0  0
 0  1  1  1  1  3  3  2  1  3  7 11 10 14 39 34 31 66 61 34 19 20 27 18  8  6  7  4  4  3  1  1  1  1  0  0  0
 1  1  1  1  1  4  3  2  2  9 11 16 24 18 40 41 13 10  7 30 41 43 47 20 10  7  3  5  4  2  1  1  1  1  0  0  0
 0  1  0  1  1  2  3  3  1  8 12 20 43 25 20 26 14 13  4 17 24 35 44 17 11  8  1  4  4  3  1  1  1  1  0  0  0
 0  1  1  1  1  2  2  3  3  9 19 23 36 20  8 20 15 11 14 25 13  5 14 12 18 11  1  1  2  4  2  1  0  1  1  0  0
 1  1  0  1  2  3  1  3  8 11 17 12 10 11 15 49 75 65 53 48 29  8  2  5 13  8  3  1  1  3  2  1  0  1  1  0  0
 1  1  0  2  1  2  2  3 11  6  4  3 12 38 45 65100 91 59 47 44 32 14  3  3  1  3  3  1  1  1  1  1  1  0  0  0
 1  1  1  3  1  2  2  2  5  2  7 18 38 77 89 83 80 65 52 53 53 42 25 17 11  2  1  3  1  2  2  1  1  1  1  0  0
 0  1  1  1  1  1  2  2  1  2 14 26 40 59 68 72 80 83 71 49 31 24 19 15 10  3  1  1  2  1  0  0  0  0  0  0  0
 0  1  1  0  0  1  2  2  2  5 10 16 22 25 27 37 55 66 53 30 17 11  9  5  2  1  1  2  2  1  0  0  0  0  0  0  0
 0  0  1  1  1  0  1  2  4  5  4  3  5 12 22 30 33 31 24 22 18  7  4  4  2  2  3  3  1  0  0  0  0  0  0  0  0
 0  0  0  0  1  1  1  1  4  4  2  0  1  6 12 17 21 21 14  9  6  3  6  6  7  8  7  3  1  0  0  0  0  0  0  0  0
 0  0  0  0  0  1  1  1  3  3  2  1  2  4  5  7 10 11  8  4  2  4  5  6  8  8  6  3  1  1  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  1  1  1  1  1  1  2  5  7  6  3  4  6  5  3  2  3  4  2  2  2  1  1  0  0  0  0  0  1  0
 0  0  0  0  0  0  0  1  1  1  0  0  1  2  3  4  4  4  4  4  4  3  3  2  1  1  0  1  1  1  1  0  0  0  0  1  0
 0  0  0  0  0  0  1  3  2  1  1  1  1  2  2  2  2  3  5  4  3  2  1  1  1  1  1  1  2  1  1  0  0  0  0  0  0
 0  0  0  0  0  0  1  2  2  1  1  1  1  2  1  1  1  1  2  3  2  1  1  0  0  1  1  1  1  1  1  0  0  0  0  0  0
 0  0  0  0  0  0  1  0  0  1  1  1  1  2  3  2  1  0  0  1  1  1  1  1  0  1  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  1  1  1  0  0  0  1  1  2  2  2  1  1  0  0  1  1  1  2  1  1  1  0  0  0  0  0  0  1  1  1  0  0  0
 0  0  1  1  2  1  1  1  0  0  1  1  1  1  1  0  0  0  1  1  1  1  1  1  1  0  0  0  0  1  1  1  1  1  0  0  0
 0  0  0  1  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  1  1  1  1  0  0  0  0  1  1  0  0  0  0  0  0  0  0
```

TO
ID

FIGURE B61

Task 2.5A - Nominal + Mfg. Error + Axial Gradient

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0285 = 100
TOTAL ENERGY = 0.2461000D+01
MAP REPRESENTS 0.2314565D+01 OR 94.0498 PERCENT OF TOTAL ENERGY

```
 0  0  1  1  1  1  0  1  0  0  1  1  1  1  1  0  0  0  0  0  1  1  1  1  1  0  0  0  0  0  1  1  1  0  0
 0  0  1  1  1  0  0  1  0  1  1  1  1  1  1  1  1  0  0  1  1  1  1  1  1  0  0  0  0  0  1  1  1  0  0
 0  0  0  1  1  0  0  1  0  1  0  0  1  1  1  1  1  0  0  0  0  1  2  1  1  1  0  0  0  0  1  1  0  0  0
 0  0  0  0  0  0  0  1  1  1  0  0  1  1  1  1  1  0  0  0  1  2  2  1  1  1  1  0  0  1  1  0  0  0  0
 0  0  0  0  0  0  1  1  1  1  0  0  1  1  1  2  3  3  1  1  2  3  3  2  1  1  1  1  1  1  1  0  0  0  0
 0  0  0  1  1  0  1  1  1  2  1  1  1  1  2  3  5  5  3  2  1  2  2  1  1  1  1  1  1  1  0  0  0  0  0
 0  0  0  0  1  1  1  0  1  2  2  3  3  2  2  2  3  5  2  2  3  2  3  2  1  1  0  1  2  1  0  0  0  0  0
 1  0  0  0  0  1  1  1  1  2  5  6  4  3  4  5  4  3  5  7  5  3  2  3  2  1  1  1  1  0  0  0  0  0  0
 0  0  0  0  0  0  1  2  2  5  7  4  3  3  3  7 10 11 13  9  7  5  1  1  1  1  2  2  0  0  0  0  0  0  0
 0  0  0  0  0  1  0  1  4  6  5  4  5  4  5  9 15 21 19 11  8  6  2  1  0  2  3  1  0  0  1  0  0  0  0
 0  0  0  0  0  1  1  2  3  2  2  7  4  4 16 15 18 31 28 26 25 14  6  3  2  4  3  1  0  0  1  1  0  0  0
 0  1  1  0  1  1  2  3  3  1  1  7 11 18 25 23 43 65 53 39 40 34 19  9  7  4  2  2  1  0  0  1  1  1  0
 1  0  0  0  1  2  2  3  3  3  2  5 20 29 27 38 64 82 74 50 42 40 22 12 11  4  2  2  1  2  1  1  0  1  1
 1  0  1  1  2  2  1  3  3  6 10  8 15 25 35 44 47 63 80 61 48 47 26 19 16  7  6  1  2  3  3  2  1  1  1
 0  1  1  2  2  2  2  3  2  3  9 10 11 21 38 38 46 89 96 50 28 35 29 23 14  9 10  3  3  4  2  2  1  1  1
 0  1  1  1  1  3  3  2  1  3  7 11 10 14 39 34 31 66 61 34 19 20 27 18  8  6  7  4  4  3  1  1  1  1  0
 1  1  1  1  1  4  3  2  2  9 11 16 24 18 40 41 13 10  7 30 41 43 47 20 10  7  3  5  4  2  1  1  1  1  0
 0  1  0  1  1  2  3  3  1  8 12 20 43 25 20 26 14 13  4 17 24 35 44 17 11  8  1  4  4  3  1  1  1  1  0
 0  1  1  1  1  2  2  3  3  9 19 23 36 20  8 20 15 11 14 25 13  5 14 12 18 11  1  1  2  4  2  1  0  1  1
 1  1  0  1  2  3  1  3  8 11 17 12 10 11 15 49 75 65 50 48 29  8  2  5 13  8  3  1  1  3  2  1  0  1  1
 1  1  0  2  1  2  2  3 11  6  4  3 12 38 45 65100 91 59 47 44 32 14  3  3  1  3  3  1  1  1  1  1  1  0
 1  1  1  3  1  2  2  2  5  2  7 18 38 77 89 83 80 65 52 53 53 42 25 17 11  2  1  3  1  2  2  1  1  1  1
 0  1  1  1  1  1  2  2  1  2 14 26 40 59 68 72 80 83 71 49 31 24 19 15 10  3  1  1  1  2  1  0  0  0  0
 0  1  1  0  0  1  2  2  2  5 10 16 22 25 27 37 55 66 53 30 17 11  9  5  2  1  1  2  2  1  0  0  0  0  0
 0  0  1  1  1  0  1  2  4  5  4  3  5 12 22 30 33 31 24 22 18  7  4  4  2  2  3  3  1  0  0  0  0  0  0
 0  0  0  0  0  1  1  1  1  4  4  2  0  1  6 12 17 21 21 14  9  6  3  6  6  7  8  7  3  1  0  0  0  0  0
 0  0  0  0  0  1  1  1  3  3  2  1  2  4  5  7 10 11  8  4  2  4  5  6  8  8  6  3  1  1  0  0  0  0  0
 0  0  0  0  0  0  0  1  1  1  1  1  1  2  5  7  6  3  4  6  5  3  2  3  4  2  2  2  1  1  0  0  0  0  1
 0  0  0  0  0  0  1  1  1  0  0  1  2  3  4  4  4  4  4  4  4  3  3  2  1  1  0  1  1  1  1  0  0  0  1
 0  0  0  0  0  1  3  2  1  1  1  1  2  2  2  2  3  5  4  3  2  1  1  1  1  1  1  1  2  1  1  0  0  0  0
 0  0  0  0  0  1  2  2  1  1  1  1  2  1  1  1  1  2  3  2  1  1  0  0  1  1  1  1  1  0  0  0  0  0  0
 0  0  0  0  0  1  0  0  1  1  1  1  2  3  2  1  1  0  0  1  1  1  1  1  0  1  0  0  0  0  0  0  0  0  0
 0  0  0  1  1  1  0  0  0  1  1  2  2  2  1  1  0  0  1  1  1  2  1  1  1  0  0  0  0  0  1  1  1  0  0
 0  0  1  1  2  1  1  1  0  0  1  1  1  1  0  0  0  0  0  1  1  1  1  1  1  1  0  0  0  1  1  1  1  0  0
 0  0  0  1  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  1  1  1  0  0  0  0  1  1  0  0  0  0  0
10
10
```

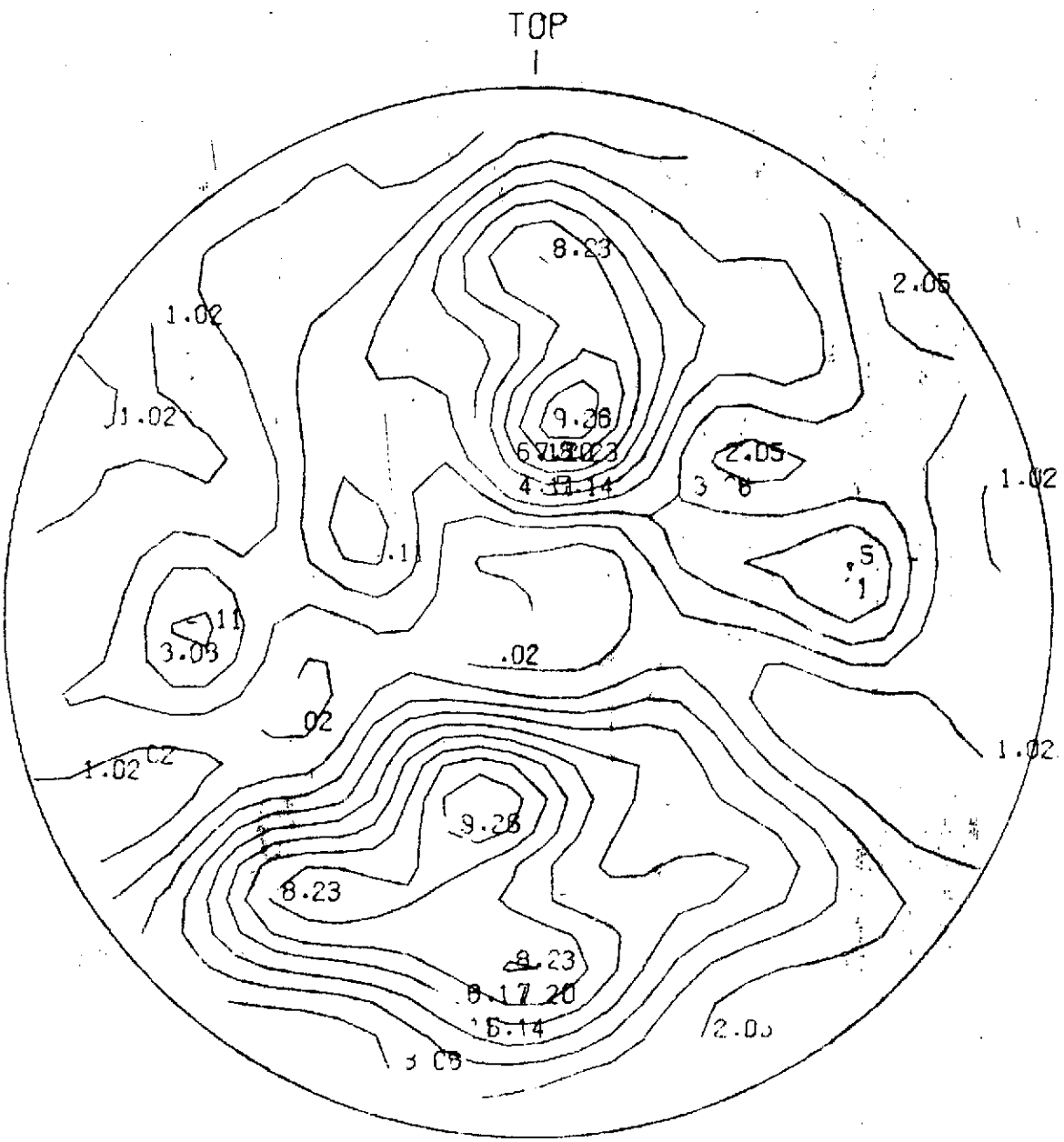
B81

IF
ID
NON IS .20 K-PK C.12 F ED AV RONT

FIGURE B62 B82

Intensity Distriubtion - Central 129 Microradians

Task 2.5A - Nominal + Mfg. Error + Axial Gradient



K+E 10 X 10 TO [illegible] INCH [illegible]
KEUFFEL & ESSER CO. [illegible]

FIGURE B63

Encircled Energy

Vs

Field Angle

Task 2.5A - Nominal

+ Mfg. Error + Axial Gradient

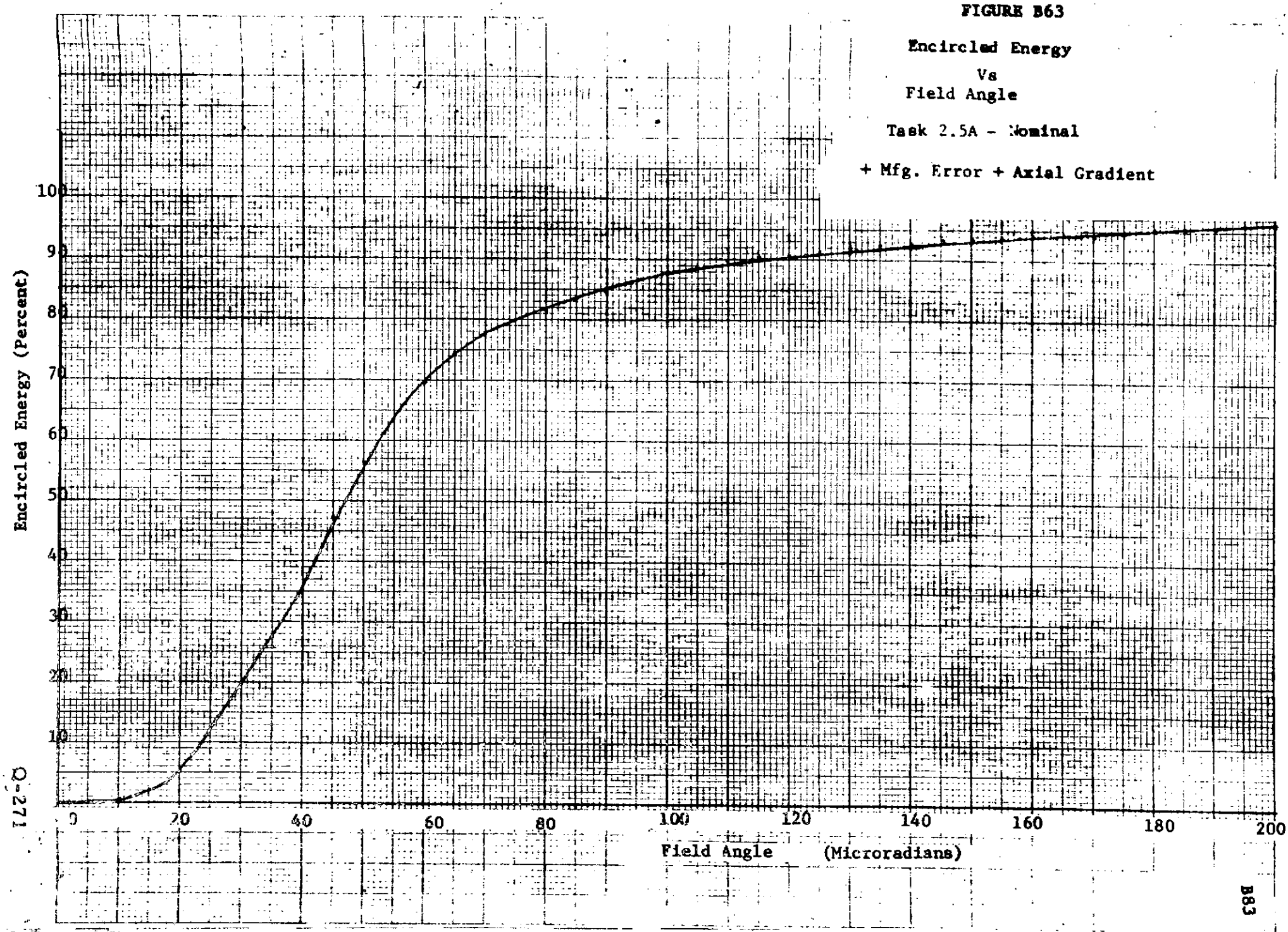


TABLE B20

ENCIRCLED ENERGY

Task 2.5B - Nominal + Mfg. Error + Radial Gradient

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
	CENTER (MICRONS):								
	X= -10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
	Y= -10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
6.00	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.1	0.0
8.00	0.1	0.1	0.1	0.1	0.1	0.0	0.2	0.2	0.1
10.00	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.2	0.2
12.00	0.3	0.3	0.3	0.2	0.1	0.1	0.3	0.4	0.3
14.00	0.3	0.3	0.4	0.3	0.3	0.3	0.5	0.4	0.3
16.00	0.5	0.4	0.4	0.4	0.3	0.4	0.5	0.6	0.5
18.00	0.6	0.5	0.5	0.6	0.6	0.5	0.7	0.6	0.6
20.00	0.8	0.7	0.7	0.7	0.6	0.7	0.8	0.7	0.8
22.00	0.9	0.7	0.8	0.9	1.0	0.9	0.9	0.8	0.9
24.00	1.1	0.9	1.0	1.1	1.1	1.0	1.0	1.0	1.1
26.00	1.2	1.0	1.2	1.3	1.4	1.2	1.2	1.1	1.2
28.00	1.5	1.2	1.5	1.5	1.5	1.5	1.4	1.3	1.5
30.00	1.7	1.4	1.6	1.7	1.8	1.7	1.6	1.4	1.7
32.00	2.1	1.8	1.9	1.9	1.9	1.8	1.8	1.8	2.0
34.00	2.2	1.9	2.1	2.1	2.1	2.1	2.1	1.9	2.1
36.00	2.7	2.4	2.4	2.3	2.3	2.3	2.4	2.5	2.6
38.00	2.9	2.7	2.7	2.6	2.5	2.6	2.7	2.7	2.9
40.00	3.5	3.4	3.2	2.9	2.7	2.9	3.2	3.4	3.5
42.00	3.7	3.7	3.7	3.3	3.1	3.4	3.8	3.8	3.8
44.00	4.6	4.6	4.2	3.8	3.4	3.8	4.3	4.7	4.7
46.00	5.2	5.3	4.8	4.4	4.0	4.4	5.1	5.5	5.4
48.00	6.1	6.3	5.7	5.2	4.4	5.1	6.0	6.6	6.3
50.00	7.0	7.2	6.5	6.0	5.6	5.9	7.0	7.6	7.3
52.00	8.3	8.5	7.5	7.0	6.3	6.9	8.0	9.1	8.6
54.00	9.0	9.4	8.8	8.2	8.0	8.1	9.3	10.0	9.4
56.00	10.7	11.0	10.5	9.8	9.0	9.7	11.1	11.8	11.1
58.00	12.1	12.5	12.0	11.3	11.1	11.1	12.6	13.4	12.6
60.00	14.2	14.8	14.0	13.3	12.8	13.1	14.7	15.8	14.8
62.00	15.5	16.0	16.3	15.6	15.0	15.4	17.1	17.1	16.1
64.00	18.7	19.3	18.1	17.8	17.1	17.5	19.0	20.4	19.3
66.00	20.5	21.2	20.8	20.9	20.0	20.6	21.8	22.4	21.2
68.00	23.7	24.4	23.2	23.0	21.9	22.8	24.3	25.6	24.4
70.00	26.0	26.6	26.2	26.4	25.5	26.1	27.4	28.0	26.8
72.00	29.3	30.0	28.5	29.1	29.1	28.9	29.7	31.3	30.1
74.00	31.3	32.0	32.4	32.5	33.1	32.3	33.6	33.3	32.1
76.00	34.6	35.4	35.6	35.6	36.2	35.4	36.8	36.6	35.6
78.00	37.4	38.0	38.5	38.5	40.1	38.3	39.6	39.2	38.4
80.00	40.5	41.3	41.9	42.2	43.2	42.1	43.0	42.4	41.5

TABLE B21

ENCIRCLED ENERGY

Task 2.5B - Nominal + Mfg. Error + Radial Gradient

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0
10.00	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.2	0.2
15.00	0.4	0.4	0.4	0.3	0.3	0.3	0.5	0.5	0.5
20.00	0.8	0.7	0.7	0.7	0.6	0.7	0.8	0.7	0.8
25.00	1.2	1.0	1.1	1.3	1.2	1.2	1.2	1.0	1.2
30.00	1.7	1.4	1.6	1.7	1.8	1.7	1.6	1.4	1.7
35.00	2.5	2.2	2.3	2.2	2.3	2.2	2.2	2.2	2.4
40.00	3.5	3.4	3.2	2.9	2.7	2.9	3.2	3.4	3.5
45.00	4.9	4.9	4.5	4.1	3.8	4.1	4.7	5.1	5.0
50.00	7.0	7.2	6.5	6.0	5.6	5.9	7.0	7.6	7.3
55.00	10.1	10.5	9.6	9.1	8.7	8.9	10.2	11.2	10.5
60.00	14.2	14.8	14.0	13.3	12.8	13.1	14.7	15.8	14.8
65.00	19.5	20.2	19.7	19.4	18.9	19.2	20.6	21.3	20.2
70.00	26.0	26.6	26.2	26.4	25.5	26.1	27.4	28.0	26.8
75.00	33.1	34.0	33.7	34.3	34.5	34.1	35.0	35.2	34.0
80.00	40.5	41.3	41.9	42.2	43.2	42.1	43.0	42.4	41.5
85.00	48.2	48.7	50.2	50.9	51.8	50.9	50.9	49.4	49.0
90.00	55.9	56.0	57.1	58.1	59.4	58.2	57.6	56.6	56.4
95.00	62.8	62.4	63.5	64.3	65.7	64.4	63.7	62.6	63.1
100.00	68.3	67.5	69.0	69.4	70.6	69.5	69.2	67.6	68.6
105.00	72.8	71.8	73.3	73.6	74.7	73.7	73.4	71.8	73.0
110.00	76.7	75.7	76.7	77.0	77.8	77.0	76.7	75.8	76.8
115.00	79.8	79.0	79.5	80.0	80.2	80.0	79.7	79.1	79.8
120.00	82.1	81.7	82.1	82.5	82.5	82.5	82.3	81.8	82.3
125.00	84.0	83.8	84.3	84.4	84.9	84.5	84.5	83.9	84.2
130.00	85.7	85.8	86.2	86.2	86.8	86.3	86.3	85.9	85.9
135.00	87.6	87.4	87.6	87.7	88.1	87.7	87.6	87.4	87.6
140.00	88.8	88.7	89.2	89.2	89.4	89.3	89.3	88.8	88.9
145.00	90.0	89.6	90.0	90.1	90.1	90.1	90.1	89.7	90.0
150.00	90.9	90.6	91.0	90.9	91.1	90.9	91.0	90.7	90.9
155.00	91.6	91.5	91.7	91.6	91.8	91.6	91.6	91.5	91.6
160.00	92.4	92.3	92.3	92.3	92.2	92.3	92.2	92.2	92.3
165.00	92.9	92.9	93.0	92.9	92.9	92.9	93.0	92.8	92.8
170.00	93.3	93.3	93.5	93.4	93.6	93.4	93.5	93.3	93.3
175.00	93.9	93.9	94.0	93.9	94.0	93.9	94.0	93.9	93.9
180.00	94.3	94.3	94.4	94.4	94.5	94.4	94.4	94.3	94.3
184.99	94.8	94.8	94.7	94.8	94.8	94.8	94.7	94.8	94.7
189.99	95.1	95.1	95.1	95.2	95.2	95.2	95.1	95.1	95.1
194.99	95.5	95.5	95.5	95.5	95.5	95.5	95.4	95.4	95.5
199.99	95.8	95.8	95.8	95.8	95.8	95.8	95.8	95.8	95.8

FIGURE 264

Wavefront Map-1 Polarization

Task 2.5B - Nominal + Mfg. Error + Radial Gradient

MAP IN UNITS OF 0.01 WAVES

886

164 153 144 137 131 144 148 152 156 164

184 172 159 148 138 129 122 115 131 136 140 144 152 163 177 190

179 167 154 142 132 123 115 108 101 115 121 125 130 138 149 162 174 184

172 161 149 136 125 115 108 102 96 89 97 104 109 114 123 134 145 155 163 171

163 154 143 130 118 108 101 95 90 85 78 78 86 93 100 108 118 127 135 143 150 158

152 145 136 124 111 100 91 86 82 79 74 68 63 70 77 86 95 104 112 118 124 132 141 150

141 135 128 118 106 93 83 78 72 70 68 63 57 48 56 64 74 83 92 99 104 110 117 126 136 147

203 129 121 112 101 89 76 67 62 60 59 57 52 46 36 44 52 62 71 79 86 91 97 104 112 123 135 222

200 187 174 99 87 74 61 53 49 48 49 46 41 34 25 32 40 49 57 65 72 78 85 92 100 186 204 219

201 186 172 158 76 61 49 40 37 37 38 35 30 23 16 21 27 33 41 49 57 65 73 81 164 183 201 217

219 202 185 169 153 140 127 38 29 26 25 26 24 18 11 6 10 13 18 24 33 42 52 128 144 161 180 199 217 232

222 204 184 166 149 135 123 112 99 14 13 12 10 6 0 -4 -1 1 4 9 18 102 113 127 142 159 178 198 217 234

226 206 184 164 146 132 121 111 99 88 80 0 -2 -6 -11 -15 -13 -11 -8 84 93 104 115 128 141 157 175 195 216 235

229 208 185 164 145 131 121 112 101 91 83 74 -14 -17 -21 -27 -24 -22 75 86 96 106 117 128 140 154 172 192 215 236

233 211 188 166 147 134 123 114 104 94 85 76 66 54 -30 -38 49 63 76 86 96 106 116 126 137 151 169 190 213 235

235 213 190 169 151 137 126 116 106 96 86 78 63 49 -38 -30 54 66 76 85 94 104 114 123 134 147 166 188 211 233

236 215 192 172 154 140 128 117 106 96 86 75 -22 -24 -27 -21 -17 -14 76 83 91 101 112 121 131 145 164 185 208 229

235 216 195 175 157 141 128 115 104 93 84 -8 -11 -13 -15 -11 -6 -2 0 80 88 99 111 121 132 146 164 184 206 226

234 217 198 178 159 142 127 113 102 10 9 4 1 -1 -4 0 6 10 12 13 14 99 112 123 135 149 166 184 204 222

232 217 199 180 161 144 128 52 42 33 24 18 13 10 6 11 18 24 26 25 26 29 38 127 140 153 169 185 202 219

217 201 183 164 81 73 65 57 49 41 33 27 21 16 23 30 35 38 37 37 40 49 61 76 158 172 186 201

219 204 186 100 92 85 78 72 65 57 49 40 32 25 34 41 46 49 48 49 53 61 74 87 99 174 187 200

222 135 123 112 104 97 91 86 79 71 62 52 44 36 46 52 57 59 60 62 67 76 85 101 112 121 129 203

147 136 126 117 110 104 99 92 83 74 64 56 48 57 63 68 70 72 76 83 93 106 118 128 135 141

150 141 132 124 118 112 104 95 86 77 70 63 68 74 79 82 86 91 100 111 124 136 145 152

158 150 143 135 127 118 108 100 93 86 78 78 85 90 95 101 108 118 130 143 154 163

171 163 155 145 134 123 114 109 104 97 89 96 102 108 115 125 136 145 161 172

184 174 162 149 130 130 125 121 110 101 108 115 123 132 142 154 167 179

198 177 163 152 140 140 135 131 115 122 129 139 148 159 172 184

164 156 152 140 144 131 137 144 153 164

FIGURE B65

Wavefront Plot-Q Polarization

Task 2.5B - Nominal + Mfg. Error + Radial Gradient

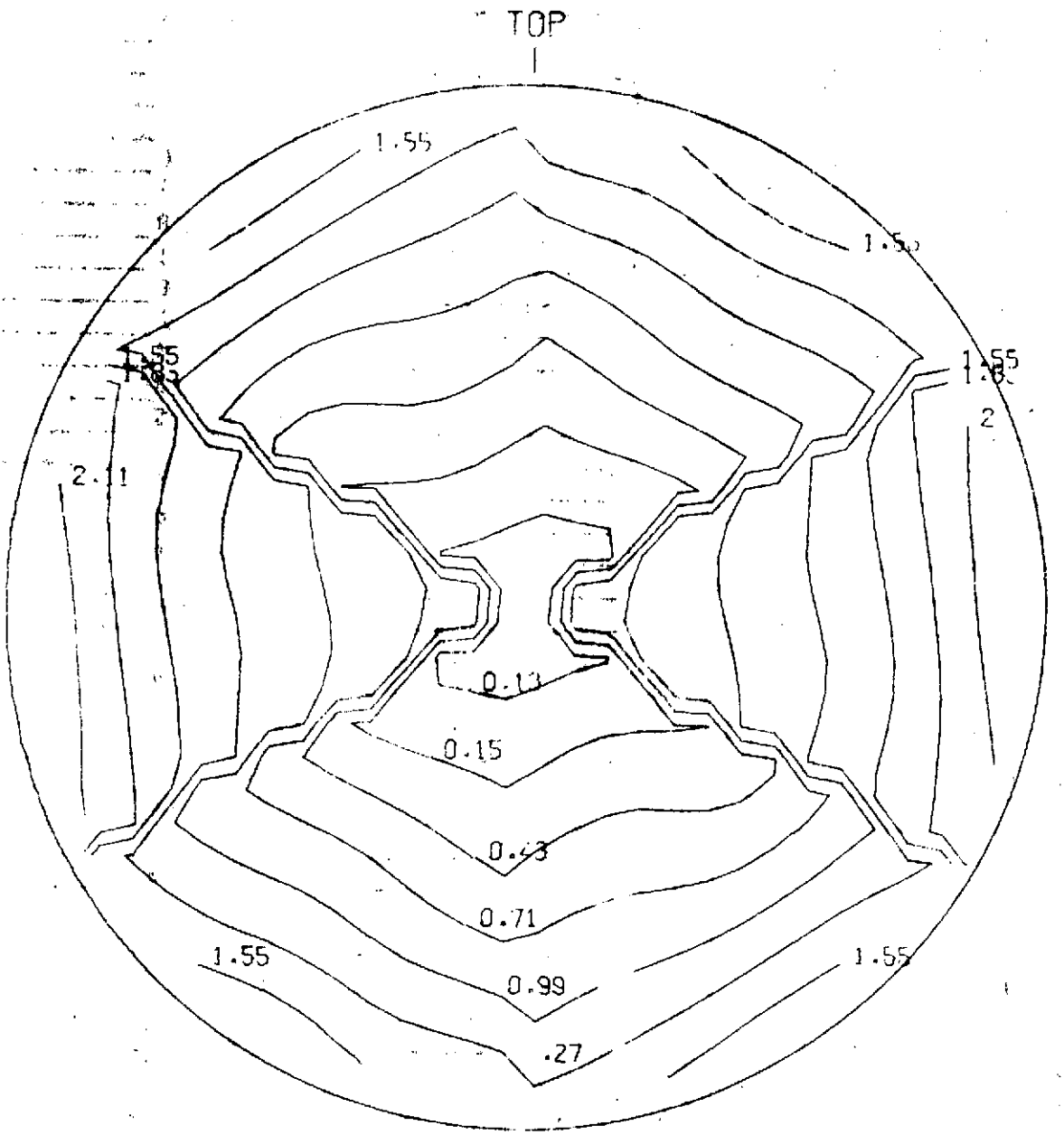


FIGURE 866

Wavefront Map-P Polarisation

Task 2.58 - Nominal + Mfg. Error + Radial Gradient

MAP IN UNITS OF 0.01 WAVES

| | | |

FIGURE B67

Wavefront Plot-P Polarization

Task 2.5B - Nominal + Mfg. Error + Radial Gradient

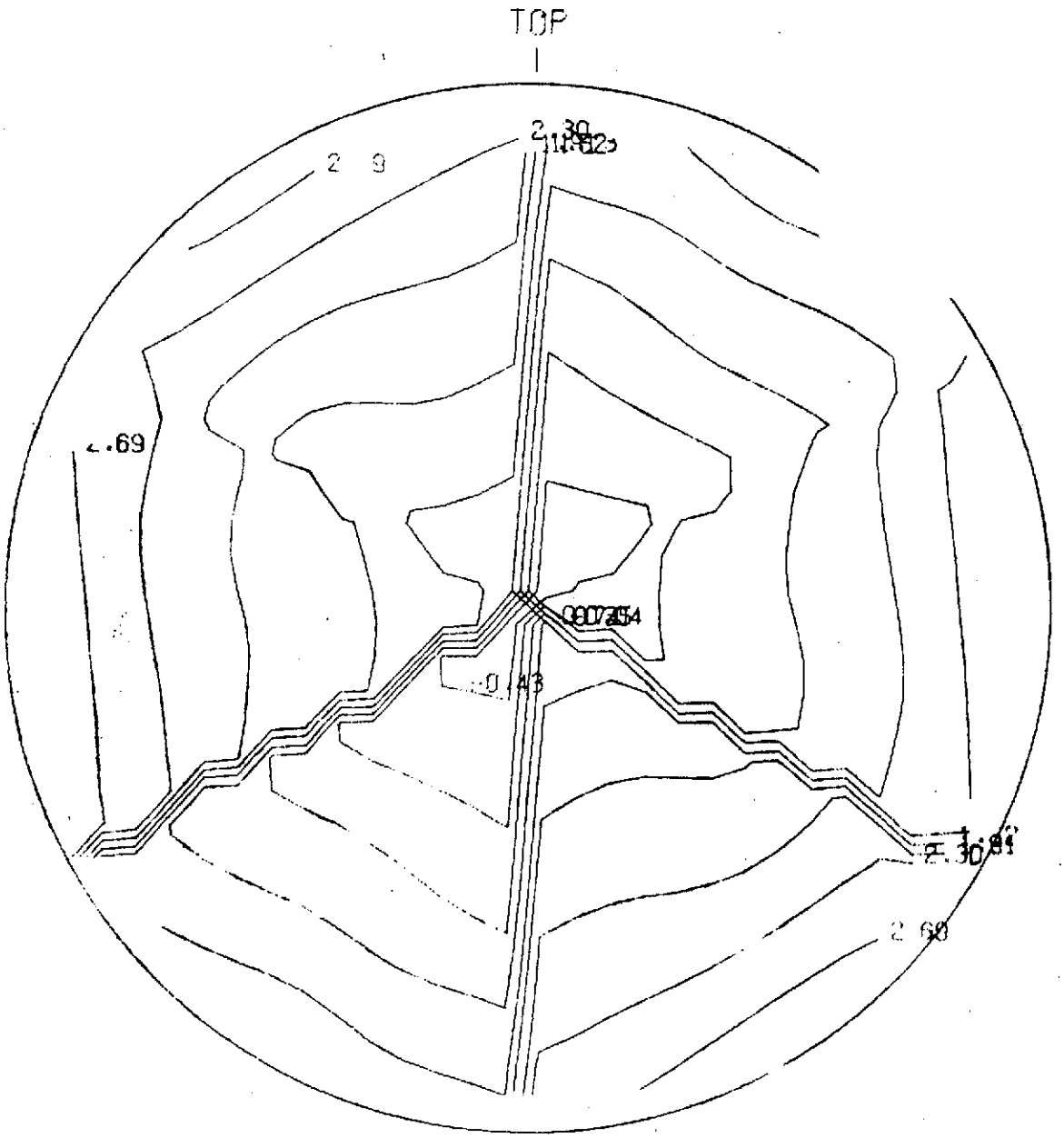


FIGURE B68

Task 2.5B - Nominal + Mfg. Error + Radial Gradient

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0153 = 100
TOTAL ENERGY = 0.2461000D+01
MAP REPRESENTS 0.2257740D+01 OR 91.7408 PERCENT OF TOTAL ENERGY

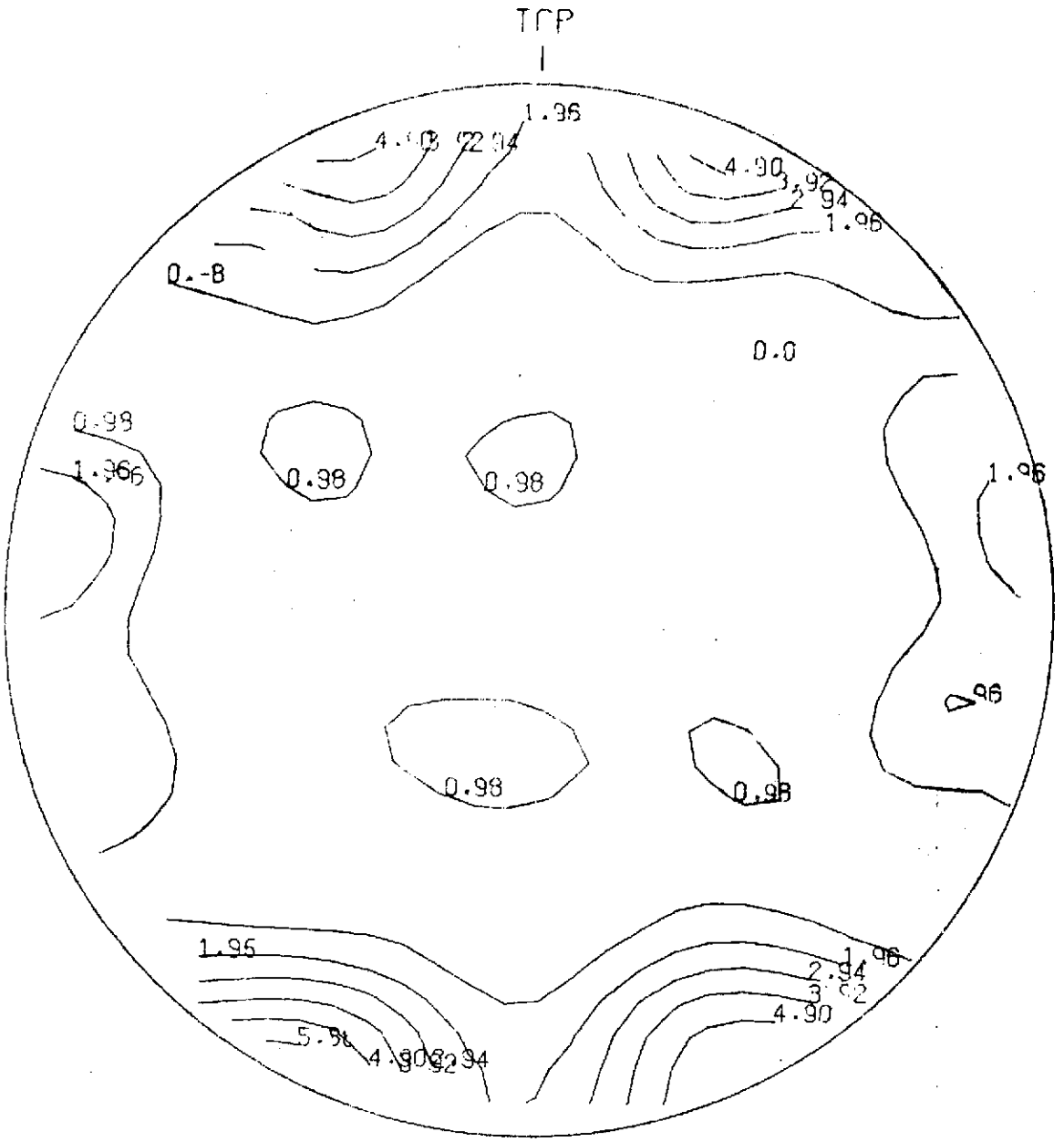
890

```
 0  0  0  0  1  2  2  3  2  2  2  1  0  0  1  3  3  4  3  2  2  1  1  1  3  2  2  2  2  2  1  0  1  0  0
 0  0  0  1  2  2  3  4  4  6  5  2  1  0  1  3  5  7  4  2  1  0  0  1  3  4  2  1  1  2  1  0  0  1
 0  1  1  1  1  1  3  7  9  9  8  5  3  2  2  3  5  7  4  2  1  0  3  4  4  5  3  1  0  1  2  2  1  1  1
 0  1  1  0  0  2  5  8 10 13 13  8  4  3  3  5  8  9  6  4  4  3  5  8  7  6  4  1  1  0  1  1  1  0  0
 1  1  1  0  1  2  5  9 13 17 16 12 10  7  3  4  7  7  5  5  9 12 16 16 12  8  4  1  0  0  0  0  1  1  1
 1  1  1  1  2  2  5  9 13 18 19 20 23 17 10  8  5  2  5 11 17 24 32 29 18 11  5  1  0  0  0  0  1  1  1
 0  0  1  2  2  3  5  6 10 17 21 28 33 30 27 19  8  3  8 26 38 43 50 44 26 14  6  1  0  0  1  1  1  1  1
 2  1  1  2  3  3  4  3  7 14 24 39 51 54 52 36 20 15 18 38 59 65 69 64 40 19  8  2  1  1  1  1  0  1  2
 2  2  2  3  4  3  2  2  3 11 28 48 61 68 62 48 33 25 27 45 69 78 76 71 49 23  9  3  2  2  2  2  1  2  2
 1  2  4  6  6  4  2  2  4 14 29 48 67 72 60 46 31 20 23 44 75 86 78 67 46 24 10  4  2  2  4  5  3  2  1
 1  2  4  6  7  6  4  3  5 11 22 43 63 62 55 46 29 18 24 47 64 64 60 52 35 18  9  5  4  3  4  3  1  1  1
 2  0  2  5  7  7  4  2  2  6 14 29 36 33 39 36 18 11 18 34 35 27 30 30 21 11  5  4  4  4  2  0  1  0  1
 1  0  2  4  4  4  3  2  2  4  7 11 14 16 21 15  5  5  8 11 10  9 14 15 13 12  9  8  7  4  4  2  1  2  0
 1  1  1  2  1  3  6  4  4  5  2  2  5  8  8  5  2  5  8  4  1  2  6  9 10 20 17 15 17  7  8  6  4  5  2
 0  1  1  1  1  5  9  8 12 12  6  4  6  9 10  8  7  9  8  4  1  3  8 13 15 29 27 25 30 16 13 10  9  9  5
 2  3  4  6  6 10 14 17 23 21 18 13  7  9 12  8  9 13  7  6  5  3  7 15 22 31 38 39 37 23 17 15 15 14  8
 5  7  9 13 15 18 21 30 34 26 28 18  3  4  7  4  3  7  3  6  4  2  2 11 23 29 45 48 36 25 19 17 18 15 10
 9 13 14 17 19 25 28 37 42 25 21 12  2  3  4  3  1  4  1  3  2  2  2 10 17 22 41 39 30 25 17 14 13 12  9
10 15 16 16 16 25 33 34 40 24 15 12  3  1  2  7  7  7  4  7  7  4  7 18 19 19 30 21 20 19 10  9  6  6  6
 9 12 11 11 13 22 33 28 34 29 18 17  7  2  4 10 14 14  9  9 11  8  9 16 15 20 22 12 13 10  4  5  2  2  2
 5  8  5  8 11 15 29 22 26 31 17 13  8  2  2  5  8  9  7  6  9  9  6  5  7 14 13  9 11  6  1  1  0  1  0
 2  4  2  4  9  8 17 15 14 20 13  8  5  2  3  4  4  3  3  6  8  5  3  1  2  4  3  5  8  4  2  2  1  1  1
 1  3  1  1  4  2  4  5  5 12 14 14 15 16 15 11  6  4  7 17 24 21 14  6  3  2  1  1  1  2  5  3  1  1
 1  1  1  0  1  2  2  2  5 13 27 37 43 46 45 34 18 11 20 39 50 49 43 28 14  5  3  2  2  1  1  4  3  2  2
 2  1  0  1  3  4  6  7 10 20 41 66 77 77 67 46 25 18 27 46 60 69 68 48 24  8  4  6  7  5  1  1  1  2  2
 2  2  1  3  6  6  7  7 13 28 54 84100 96 74 43 23 20 32 51 69 81 77 56 31 12  3  5  7  7  6  3  2  1  1
 1  1  1  2  5  4  3  2  8 25 51 76 89 88 72 48 29 25 36 55 71 77 69 50 27 10  2  2  5  6  7  5  2  1  1
 1  1  1  1  2  2  1  0  5 16 37 57 67 68 57 36 19 14 20 36 53 60 55 40 23 12  6  4  5  5  5  4  2  3  2
 2  2  1  1  0  0  0  1  5 13 27 44 52 50 42 24  7  3  7 19 31 37 37 32 26 19 12  8  6  4  3  2  2  2  1
 1  1  1  0  0  0  1  2  6 13 20 30 33 26 20 13  5  2  5 10 12 15 20 21 21 19 15 11  6  2  1  1  1  0  0
 0  1  1  1  1  0  0  2  6 11 15 17 15 10  5  4  6  7  7  4  2  5 10 13 17 18 14  9  4  1  0  0  1  1  1
 0  1  2  2  1  1  0  1  3  7  9  9  5  3  2  3  6  9  8  5  3  3  5  9 13 13  9  6  3  1  1  1  1  1  1
 1  1  1  2  2  1  1  1  2  4  5  4  2  0  2  3  5  7  6  4  2  2  3  6  7  8  8  6  4  2  1  1  1  1  1
 1  0  0  1  2  2  1  2  2  3  3  1  1  0  2  3  6  7  4  2  1  0  1  2  3  4  4  4  3  2  2  1  1  0  0
 0  0  0  0  1  2  2  2  2  2  2  1  0  1  2  2  3  4  2  1  1  0  0  0  1  2  3  3  2  2  1  0  0  0  0
ID
ID
```

FIGURE B69

Intensity Distriubtion - Central 129 Microradians

Task 2.5B - Nominal + Mfg. Error + Radial Gradient



REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

FIGURE B70

Encircled Energy

Vs

Field Angle

Task 2.5B - Nominal

+ Mfg. Error + Radial Gradient

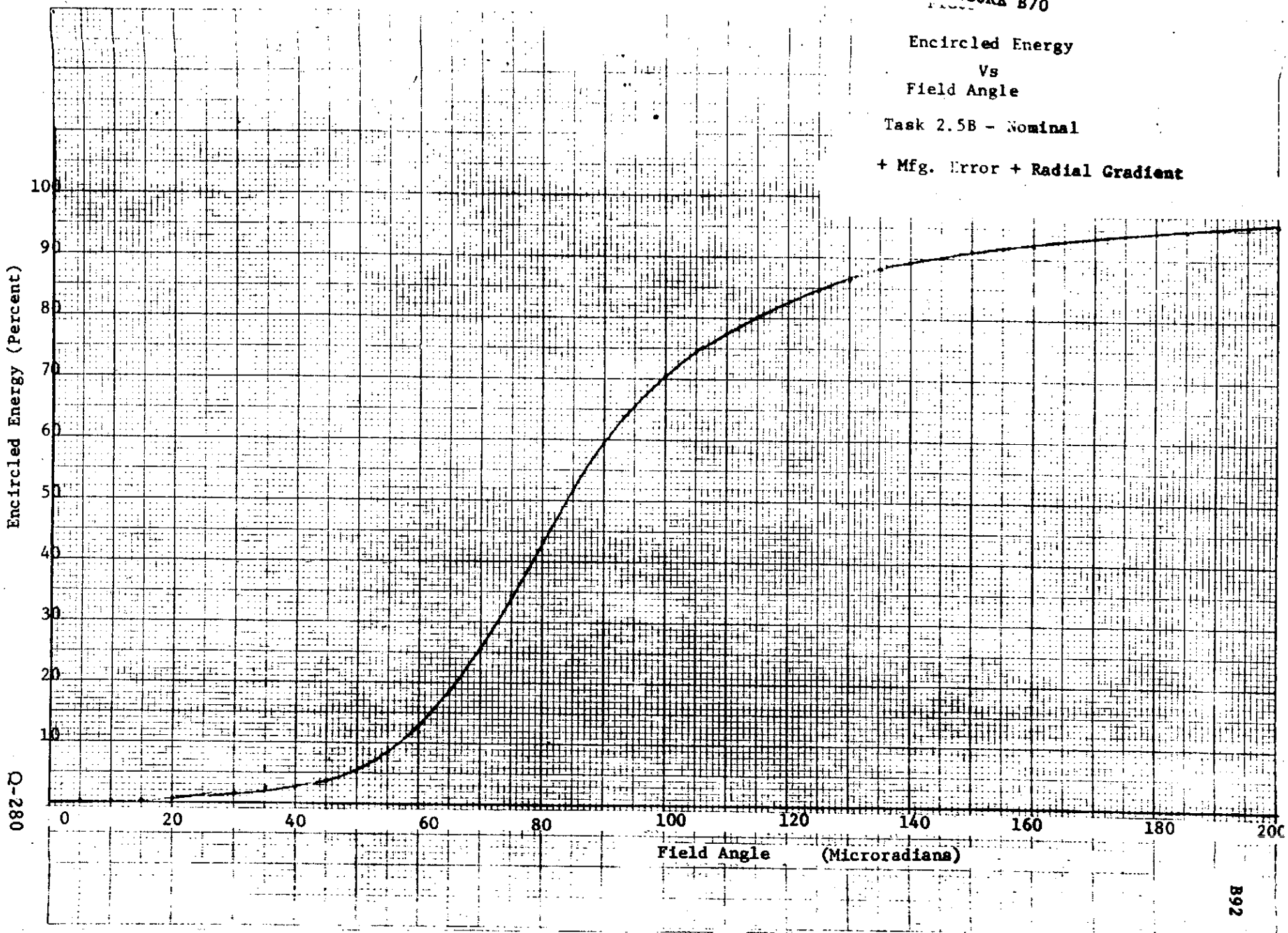


TABLE B22

ENCIRCLED ENERGY

Task 2.4A - Off Nominal Cube + Mfg. Error-On Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.00	0.1	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.1
6.00	0.1	0.1	0.0	0.2	0.2	0.2	0.1	0.1	0.1
8.00	0.2	0.2	0.1	0.3	0.2	0.3	0.1	0.2	0.3
10.00	0.3	0.3	0.2	0.4	0.3	0.4	0.2	0.3	0.3
12.00	0.8	0.7	0.3	0.6	0.4	0.6	0.4	0.7	0.7
14.00	0.8	0.7	0.6	0.8	0.6	0.8	0.7	0.7	0.7
16.00	1.3	1.2	0.9	1.0	0.7	1.0	1.0	1.2	1.2
18.00	1.6	1.4	1.3	1.3	1.3	1.3	1.3	1.4	1.4
20.00	2.3	2.1	2.0	1.7	1.3	1.7	2.0	2.2	2.1
22.00	2.6	2.4	2.6	2.1	2.0	2.0	2.5	2.5	2.5
24.00	3.7	3.5	3.4	2.6	2.4	2.6	3.3	3.7	3.6
26.00	4.3	4.1	4.2	3.3	3.3	3.2	4.1	4.4	4.3
28.00	6.0	6.0	5.8	4.5	3.5	4.3	5.9	6.3	6.2
30.00	7.1	7.0	6.8	5.6	5.1	5.5	7.0	7.5	7.3
32.00	9.4	9.4	8.4	6.8	5.9	6.6	8.9	10.1	9.8
34.00	10.0	10.0	9.9	9.0	8.0	8.7	10.7	10.7	10.3
36.00	12.6	12.7	11.9	10.5	9.8	10.2	13.0	13.7	13.2
38.00	14.0	14.0	13.8	13.0	13.3	12.8	15.0	15.2	14.8
40.00	16.8	16.8	16.3	15.2	15.0	14.8	17.7	18.2	17.8
42.00	18.1	18.1	19.2	18.7	19.5	18.4	20.5	19.6	19.1
44.00	21.7	21.5	21.7	20.8	21.6	20.4	23.1	23.2	22.9
46.00	24.1	23.9	24.8	25.2	26.4	24.8	26.2	25.8	25.5
48.00	27.9	27.6	28.8	28.7	27.8	28.3	30.2	29.5	29.2
50.00	30.9	30.6	31.2	31.9	32.6	31.6	32.8	32.6	32.3
52.00	35.1	34.7	35.1	35.5	35.3	35.2	36.5	36.6	36.4
54.00	37.3	37.0	38.0	39.3	40.1	39.1	39.8	38.8	38.5
56.00	41.4	41.2	42.5	43.2	43.2	43.0	44.2	42.8	42.6
58.00	44.4	44.3	45.4	46.1	48.3	46.0	47.1	45.8	45.6
60.00	47.8	47.7	49.2	49.8	51.8	49.8	50.7	49.1	49.0
62.00	50.2	50.1	52.5	53.7	55.9	53.7	53.9	51.3	51.3
64.00	54.3	54.3	55.4	56.4	59.0	56.4	56.6	55.3	55.4
66.00	56.8	56.8	58.9	60.4	62.6	60.4	59.8	57.6	57.8
68.00	60.4	60.4	61.8	62.8	64.3	62.9	62.3	61.1	61.3
70.00	62.5	62.6	64.5	65.7	67.2	65.8	64.8	63.0	63.3
72.00	65.8	65.8	66.8	67.8	69.5	68.0	67.0	66.1	66.3
74.00	67.4	67.4	69.3	70.1	71.6	70.2	69.3	67.6	67.8
76.00	70.1	70.1	71.5	71.8	73.1	72.0	71.5	70.2	70.4
78.00	71.8	71.8	72.9	73.2	74.9	73.4	72.9	71.8	71.9
80.00	73.7	73.6	74.7	74.8	76.0	75.0	74.7	73.6	73.8

TABLE B23

ENCIRCLED ENERGY

Task 2.4A - Off Nominal Cube + Mfg. Error-On Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.1	0.1	0.0	0.2	0.1	0.1	0.1	0.1	0.1
10.00	0.3	0.3	0.2	0.4	0.3	0.4	0.2	0.3	0.3
15.00	1.1	1.0	0.8	1.0	0.7	1.0	0.8	1.0	0.9
20.00	2.3	2.1	2.0	1.7	1.3	1.7	2.0	2.2	2.1
25.00	4.1	3.9	4.0	3.2	2.8	3.1	3.9	4.1	4.1
30.00	7.1	7.0	6.8	5.6	5.1	5.5	7.0	7.5	7.3
35.00	11.5	11.6	10.8	9.4	9.3	9.1	11.7	12.4	12.0
40.00	16.8	16.8	16.3	15.2	15.0	14.8	17.7	18.2	17.8
45.00	23.0	22.8	23.3	23.7	24.5	23.2	24.8	24.6	24.2
50.00	30.9	30.6	31.2	31.9	32.6	31.6	32.8	32.6	32.3
55.00	40.0	39.7	40.6	41.2	42.4	41.0	42.2	41.4	41.2
60.00	47.8	47.7	49.2	49.8	51.8	49.8	50.7	49.1	49.0
65.00	55.4	55.5	57.5	58.8	61.1	58.8	58.6	56.4	56.5
70.00	62.5	62.6	64.5	65.7	67.2	65.8	64.8	63.0	63.3
75.00	69.0	69.0	70.5	71.0	72.4	71.2	70.5	69.1	69.2
80.00	73.7	73.6	74.7	74.8	76.0	75.0	74.7	73.6	73.8
85.00	77.1	76.8	78.0	78.2	78.9	78.2	78.2	76.9	77.3
90.00	80.0	79.5	80.3	80.7	80.9	80.6	80.5	79.7	80.2
95.00	82.4	81.9	82.3	82.6	82.7	82.6	82.4	82.1	82.6
100.00	84.1	83.8	84.1	84.3	84.4	84.3	84.2	83.9	84.2
105.00	85.5	85.4	85.7	85.9	86.1	85.9	85.8	85.5	85.6
110.00	86.8	87.0	87.1	87.2	87.5	87.3	87.2	87.1	87.0
115.00	88.0	88.4	88.4	88.4	88.7	88.4	88.5	88.4	88.1
120.00	89.1	89.5	89.5	89.4	89.7	89.5	89.5	89.5	89.1
125.00	90.0	90.4	90.4	90.3	90.5	90.3	90.4	90.3	90.0
130.00	90.8	91.0	91.1	91.1	91.2	91.1	91.1	91.1	90.8
135.00	91.7	91.6	91.7	91.7	91.8	91.6	91.6	91.6	91.6
140.00	92.2	92.2	92.2	92.3	92.3	92.3	92.2	92.2	92.1
145.00	92.6	92.7	92.7	92.7	92.7	92.7	92.7	92.7	92.6
150.00	93.0	93.1	93.1	93.1	93.2	93.2	93.1	93.1	93.0
155.00	93.4	93.4	93.5	93.5	93.6	93.5	93.5	93.5	93.4
160.00	93.8	93.8	93.9	93.8	93.9	93.8	93.9	93.8	93.8
165.00	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.1
170.00	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.4	94.4
175.00	94.8	94.8	94.8	94.8	94.7	94.8	94.8	94.8	94.8
180.00	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1
184.99	95.3	95.3	95.3	95.3	95.4	95.4	95.3	95.4	95.4
189.99	95.6	95.6	95.6	95.7	95.7	95.7	95.6	95.6	95.6
194.99	95.9	95.9	95.9	95.9	95.9	95.9	95.9	95.9	95.9
199.99	96.1	96.1	96.1	96.2	96.1	96.2	96.1	96.2	96.2

FIGURE B71

Wavefront Map-0 Polarization

Task 2.4A - Off Nominal Cube + Mfg. Error-On Axis

B95

MAP IN UNITS OF 0.01 WAVES

```
                                                53  45  38  32  27  39  41  42  43  46
                                            71  62  52  44  36  29  23  17  33  36  36  37  41  48  57  65
                                        69  61  51  42  35  28  22  16  10  23  27  28  30  34  41  49  56  62
                                    67  58  50  41  32  25  20  16  10   4  11  16  18  21  26  32  39  44  48  50
                                61  55  47  38  29  21  16  13   9   5  -1  -2   3   8  12  17  23  28  31  33  36  39
                            52  49  43  35  25  17  10   7   5   3   0  -6 -13  -7  -1   3   9  14  18  20  22  24  27  32
                        49  40  37  31  22  12   5   0  -1  -1  -3  -7 -13 -23 -16 -10  -3   2   7  10  11  12  15  18  23  28
                    204  34  30  26  19  10   0  -6  -9  -8  -8  -9 -14 -20 -31 -25 -18 -11  -4   0   2   3   4   6  10  15  20 202
                202 194 187  16   9   0 -10 -16 -18 -16 -15 -16 -21 -28 -38 -32 -26 -20 -14 -10  -7  -5  -3  -1   1 181 193 202
            202 193 186 178   0 -10 -20 -26 -26 -24 -22 -24 -29 -36 -44 -40 -36 -32 -27 -23 -19 -15 -12  -9 169 182 193 203
        213 203 193 183 174 165 157 -28 -34 -35 -33 -32 -33 -38 -46 -52 -49 -47 -45 -41 -37 -31 -25 145 157 170 183 195 206 214
    215 204 192 181 170 161 154 146 137 -44 -44 -43 -44 -48 -55 -60 -59 -58 -57 -54 -49 130 138 146 158 170 183 196 208 217
217 205 192 178 166 158 152 145 137 130 124 -55 -56 -59 -64 -69 -68 -68 -68 121 128 135 143 151 160 170 182 196 209 220
220 207 192 177 165 156 151 146 139 132 126 122 -66 -68 -72 -78 -77 -78 116 125 133 140 147 154 161 169 181 195 209 222
222 208 193 178 166 157 152 147 141 134 127 121 114 104 -80 -89  97 110 119 128 135 142 148 154 159 168 179 194 209 223
223 209 194 179 168 159 154 148 142 135 128 119 110  97 -89 -80 104 114 121 127 134 141 147 152 157 166 178 193 208 222
222 209 195 181 169 161 154 147 140 133 125 116 -78 -77 -78 -72 -68 -66 122 126 132 139 146 151 156 165 177 192 207 220
220 209 196 182 170 160 151 143 135 128 121 -68 -68 -68 -69 -64 -59 -56 -55 124 130 137 145 152 158 166 178 192 205 217
217 209 196 183 170 158 148 138 130 -49 -54 -57 -58 -59 -60 -55 -48 -44 -43 -44 -44 137 146 154 161 170 181 192 204 215
214 206 195 183 170 157 145 -25 -31 -37 -41 -45 -47 -49 -52 -46 -38 -33 -32 -33 -35 -34 -28 157 165 174 183 193 203 213
    203 193 182 169  -9 -12 -15 -19 -23 -27 -32 -36 -40 -44 -36 -29 -24 -22 -24 -26 -26 -20 -10   0 178 186 193 202
202 193 181   1  -1  -3  -5  -7 -10 -14 -20 -26 -32 -38 -28 -21 -16 -15 -16 -18 -16 -10   0  -9  16 187 194 202
202  20  15  10   6   4   3   2   0  -4 -11 -18 -25 -31 -20 -14  -9  -8  -8  -9  -6   0  10  19  26  30  34 204
        28  23  18  15  12  11  10   7   2  -3 -10 -16 -23 -13  -7  -3  -1  -1   0   5  12  22  31  37  40  43
            32  27  24  22  20  18  14   9   3  -1  -7 -13  -6   0   3   5   7  10  17  25  35  43  49  52
                39  36  33  31  28  23  17  12   8   3  -2  -1   5   9  13  16  21  29  38  47  55  61
                    50  48  44  39  32  26  21  18  16  11   4  10  16  20  25  32  41  50  58  67
                        62  56  49  41  34  30  28  27  23  10  16  22  28  35  42  51  61  69
                            65  57  48  41  37  36  36  33  17  23  29  36  44  52  62  71
                                46  43  42  41  39  27  32  38  45  53
```

ADD ON AXIS AVERAGE AVERAGE AVERAGE PLOT NUMBER 2
1
NONE RMS 0.86 PK-PK 3.13 FRED WAVEFRONT

FIGURE B72

Wavefront Plot-Q Polarization

Task 2.4A - Off Nominal Cube + Mfg. Error-On Axis

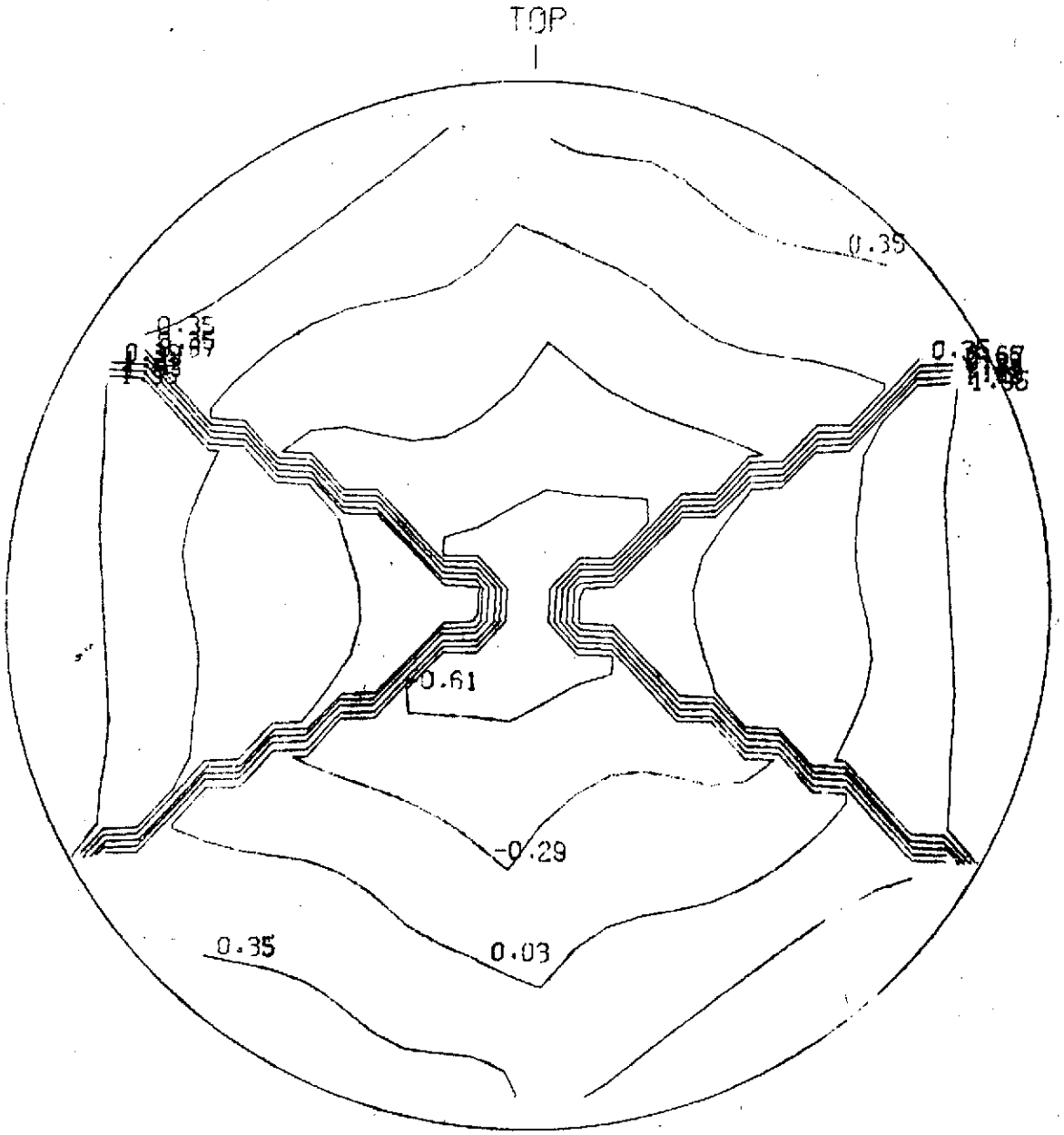


FIGURE B73

Wavefront Map-P Polarization

Task 2.4A - Off Nominal Cube + Mfg. Error+On Axis

MAP IN UNITS OF 0.01 WAVES

897

```
                                    212 204 197 191 185  47  50  50  51  55
                                230 220 211 202 195 188 182 176  41  44  45  46  49  56  65  74
                            228 219 210 201 193 187 181 175 168  32  35  37  38  42  49  57  65  70
                        229 217 208 199 191 184 179 174 169 162  19  24  27  29  34  41  47  52  56  59
                    219 214 205 196 187 180 175 171 168 163 157   6  12  16  20  25  31  36  40  42  44  47
                210 207 201 193 184 175 169 166 164 161 157 151  -5   1   6  12  17  23  27  29  30  32  36  40
            201 199 195 189 181 171 163 159 157 157 155 151 145 -14  -8  -1   4  11  16  19  20  21  23  27  32  37
        219 192 189 184 178 168 159 152 149 149 150 148 144 137 -22 -16  -9  -2   3   8  11  12  13  15  18  23  29  68
    218 210 203 175 167 157 147 141 140 141 143 141 137 130 -29 -24 -18 -12  -6  -1   1   3   5   7  10  47  59  68
    218 209 202 194 159 148 138 132 131 133 135 134 129 121 -36 -32 -28 -23 -19 -14 -10  -7  -3   0  35  48  59  69
229 219 209 199 190 181 173 130 124 122 124 126 124 119 112 -43 -41 -39 -36 -33 -28 -23 -17  11  23  36  49  61  72  80
231 220 208 197 186 177 170 162 153 113 114 115 113 109 102 -51 -50 -49 -48 -46 -41  -3   4  14  24  36  49  62  74  83
233 221 208 194 182 174 168 161 153 146 140 103 102  99  94 -60 -59 -60 -60 -12  -5   1   9  17  26  36  48  62  75  86
236 223 208 193 181 172 167 162 155 148 142 138  92  89  86 -70 -69 -69 -17  -8   0   6  13  19  26  35  47  61  75  88
238 224 209 194 182 173 168 163 157 150 143 137 130 120  78 -81 -36 -24 -14  -5   1   8  14  20  25  34  45  60  75  89
239 225 210 195 184 175 170 164 158 151 144 135 125 113 -69  89 -29 -19 -12  -6   0   7  13  18  23  32  44  59  74  88
239 225 211 197 185 176 169 163 156 149 141 132 -58 -57 -58  97 101 103 -11  -7  -1   5  12  17  22  31  43  58  73  86
236 225 212 198 186 176 167 159 151 144 137 -48 -48 -48 -49 105 110 114 115  -9  -3   3  11  18  24  32  44  58  71  83
233 224 212 199 186 174 164 154 146 -29 -34 -37 -38 -38 -40 114 121 125 126 126 125   3  12  20  27  36  47  58  70  81
230 222 211 199 186 173 161  -5 -11 -16 -21 -25 -27 -29 -32 124 131 136 137 136 134 135 141  23  31  40  49  59  69  79
    219 209 198 185  10   7   4   0  -3  -7 -12 -16 -20 -24 133 140 145 147 145 143 144 150 160 170  44  52  59  68
    218 209 197  21  18  16  14  12   9   5   0  -6 -12 -18 141 148 153 155 153 152 153 159 169 179 187  53  60  68
    218  40  35  30  26  24  23  22  19  15   8   1  -5 -11 149 156 160 161 161 161 163 170 180 189 196 200 204  69
        49  43  38  35  32  31  30  27  22  16   9   3  -3 156 163 167 168 169 170 175 183 192 201 207 210 213
        52  47  44  42  40  38  34  29  23  18  12   6 163 169 173 175 177 181 187 196 205 213 219 222
        59  56  53  51  48  43  37  32  28  23  17 168 175 180 183 186 192 199 208 217 225 231
        70  68  64  59  52  46  41  38  36  31 174 181 185 191 196 202 211 220 229 237
            82  76  69  61  54  50  50  47  40 180 186 192 198 205 213 221 231 240
            89  77  68  61  57  56  56  53 187 196 200 207 214 223 232 242
                66  63  62  61  59 197 203 208 216 224
```

400	ON AXIS	AVERAGE	AVERAGE	AVERAGE			
1							
NONE		RMS	0.94	PK-PK	3.23	FREQ	WAVEFRONT

FIGURE B74

Wavefront Plot-P Polarization

Task 2.4A - Off Nominal Cube + Mfg. Error-On Axis

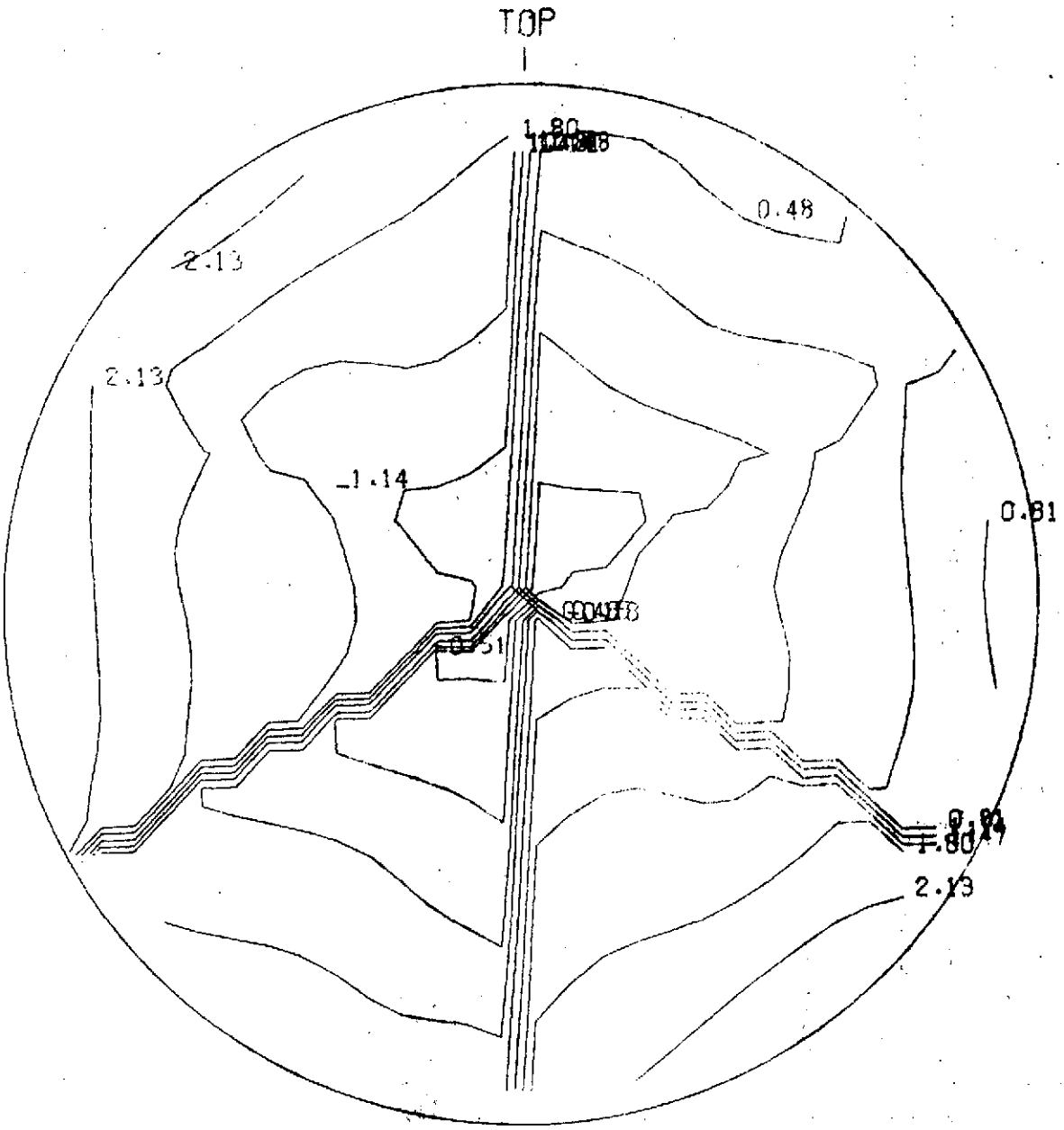


FIGURE B75

Task 2.4A - Off Nominal Cube + Mfg. Error-On Axis

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0192 = 100
TOTAL ENERGY = 0.24610000+01
MAP REPRESENTS 0.23057200+01 OR 93.6904 PERCENT OF TOTAL ENERGY

```
 1  1  1  1  0  0  1  1  1  0  0  1  1  1  1  1  0  1  0  1  2  2  1  1  1  1  1  1  0  0  1  1  1  1  1
 0  1  1  1  0  0  1  1  1  1  1  0  0  1  1  3  2  0  0  0  2  4  4  2  0  1  1  1  1  1  0  0  1  1  1  1
 0  1  1  0  1  1  1  1  1  1  0  1  1  1  3  3  2  2  1  1  2  3  3  1  1  1  1  1  1  0  0  0  1  1  1  0
 0  0  0  0  0  1  1  1  2  2  1  1  1  1  2  3  4  3  2  1  1  2  2  1  1  1  1  1  1  1  0  0  0  0  0  0
 0  0  0  1  1  0  0  1  3  4  3  3  2  1  2  4  5  4  2  2  2  2  3  2  2  1  1  1  1  1  1  1  0  0  0  0
 0  0  0  1  1  1  1  1  3  6  6  5  4  2  4  6 10 11  6  4  2  1  3  3  2  2  0  1  1  1  1  1  0  0  0  0
 0  0  1  1  1  2  2  3  7  9  8  9  6  4  4  5 12 15  6  5  6  3  4  3  1  1  0  1  1  1  1  1  1  0  0  0
 1  0  0  1  1  2  3  6 10  9 10 12  8  7  7  5 10 13  9 11 13  7  5  5  1  0  1  1  1  1  1  1  1  0  0  0
 1  0  0  1  1  1  3  5  6  9 12 10 10 16 16 17 18 16 19 26 28 21 11  5  1  0  2  1  1  1  1  1  1  0  0  0
 0  0  1  1  1  3  3  2  2  6  9 13 24 31 32 38 41 36 38 45 43 35 24 11  3  2  3  2  2  1  1  0  1  1  1  1
 1  0  0  1  3  4  4  2  1  1  9 24 31 38 53 55 51 52 56 70 65 41 27 17  7  4  3  2  2  1  1  1  1  1  0  1
 1  1  2  2  3  4  5  4  3  4 16 30 38 59 74 59 60 70 61 74 85 62 36 22 12  6  4  4  2  1  1  2  2  2  1  1
 1  2  2  2  2  4  5  5  5  7 15 24 44 72 69 56 82100 74 60 70 59 35 24 14  5  5  5  3  1  1  1  2  2  1  1
 1  1  1  1  2  4  4  4  6  7 16 21 31 48 47 45 54 61 54 44 45 37 24 24 15  7  6  3  3  2  2  2  1  1  1  1
 1  1  0  3  4  5  3  4 11 11 20 24 20 28 36 31 17 16 24 25 22 26 30 27 19 16 14  4  3  5  4  3  0  1  1  1
 1  1  1  4  6  7  5  6 14 19 27 26 19 17 23 17  4  6 13 17  4 16 32 21 23 21 18 10  5  6  5  4  2  1  1  1
 2  1  2  6  7 10  8  7 12 26 36 26 26 19 21 22  7  2  4 16 12 35 43 20 29 23 16 15  8  7  6  7  4  2  1  1
 2  2  3  7  7  8  7 10 12 26 39 28 43 33 15 20 12 13 12 16 21 45 45 26 39 24 12 11  8 10  7  7  3  2  2  1
 1  2  3  6  5  6  5 13 16 24 40 32 41 27  4 11  3  4 11 15 13 20 23 35 47 26 13  5  5 10  7  5  1  1  2  2
 0  1  2  4  3  4  4 12 19 18 26 20 18 15  7 17 14  6  8 11  9  5  5 21 31 23 18  5  2  4  4  4  1  0  1  1
 0  1  1  3  2  3  4  6 13  7  8 14 21 35 35 28 22 15 17 28 35 25  8  6  6 10 15  7  3  1  2  3  1  1  0  1
 0  1  1  3  1  1  2  1  3  1 10 28 39 58 69 63 59 60 60 62 67 58 40 25  9  1  3  4  5  4  2  2  1  1  1  1
 1  1  1  2  1  0  1  2  3  5 16 34 48 63 75 76 85100 91 72 73 74 58 37 18  6  2  1  4  4  2  2  1  1  1  1
 1  2  2  1  0  1  2  6  9 11 15 26 49 75 90 82 70 70 69 73 82 72 48 29 18 11  5  2  1  1  3  4  2  1  1  1
 1  1  2  1  1  1  3  5  7  7  7 15 33 57 79 79 63 52 54 67 70 51 33 19  8  4  3  2  1  1  2  2  1  1  0  1
 1  0  0  0  1  2  3  3  3  1  1  8 19 29 38 40 38 38 38 36 33 30 23 12  5  4  3  3  3  2  1  0  0  0  0  0
 1  0  1  1  1  2  2  1  1  1  1  5 11 18 24 24 19 16 17 16 15 16 13 12 14 12  9  8  6  3  1  1  0  0  0  1
 0  0  1  1  1  1  0  0  1  1  3  5  5  7 13 17 15 13 12 10  9  7  8 12 14 12 13 10  6  3  2  1  0  0  0  1
 0  0  0  1  1  1  1  1  1  0  2  3  5  5  4  4  5  9 16 12  5  4  4  7 10 10  9  7  4  2  2  1  0  0  0  0
 0  0  0  1  1  2  2  2  1  1  1  2  2  1  2  3  6 11  9  5  3  2  4  5  5  4  2  0  0  1  1  0  0  0  0  0
 0  0  0  1  1  1  2  2  1  1  1  1  2  1  2  2  3  4  5  5  3  2  2  2  2  2  2  1  1  1  1  1  1  1  0  0
 0  1  1  1  0  0  1  1  2  1  1  1  2  3  2  2  3  4  4  3  1  1  1  1  1  2  2  2  2  2  1  1  1  1  0  0
 0  1  1  1  1  1  1  1  1  1  1  1  2  2  3  2  1  1  0  1  3  2  1  1  0  1  1  2  2  1  1  0  0  1  1  0
 0  1  1  1  1  1  1  1  1  1  1  1  1  2  2  1  1  1  0  1  2  1  1  1  0  0  0  1  0  0  1  1  1  1  1  1
10
ID
```

FIGURE B76

Intensity Distriubtion - Central 129 Microradians

Task 2.4A - Off Nominal Cube + Mfg. Error-On Axis

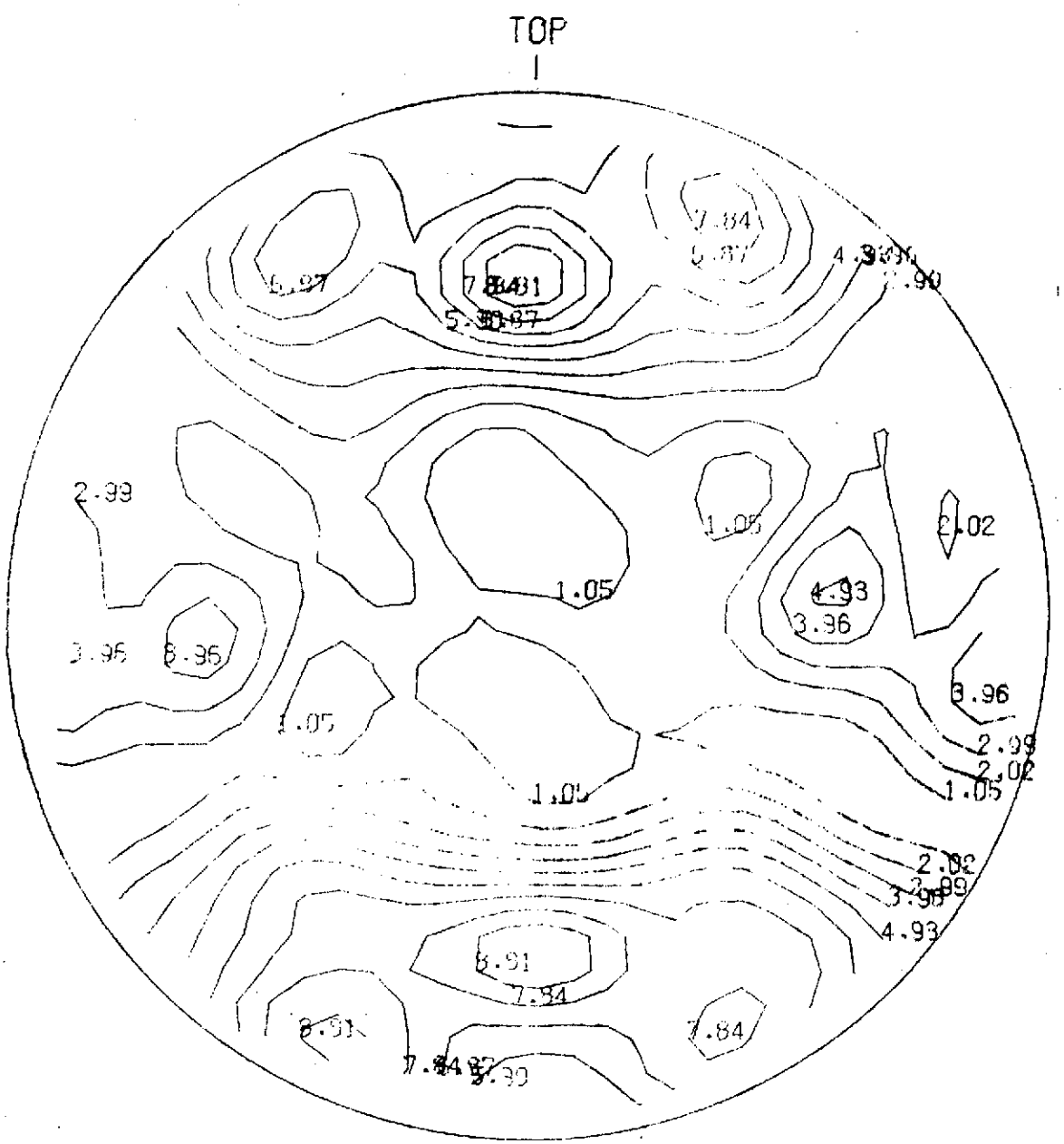


FIGURE B77

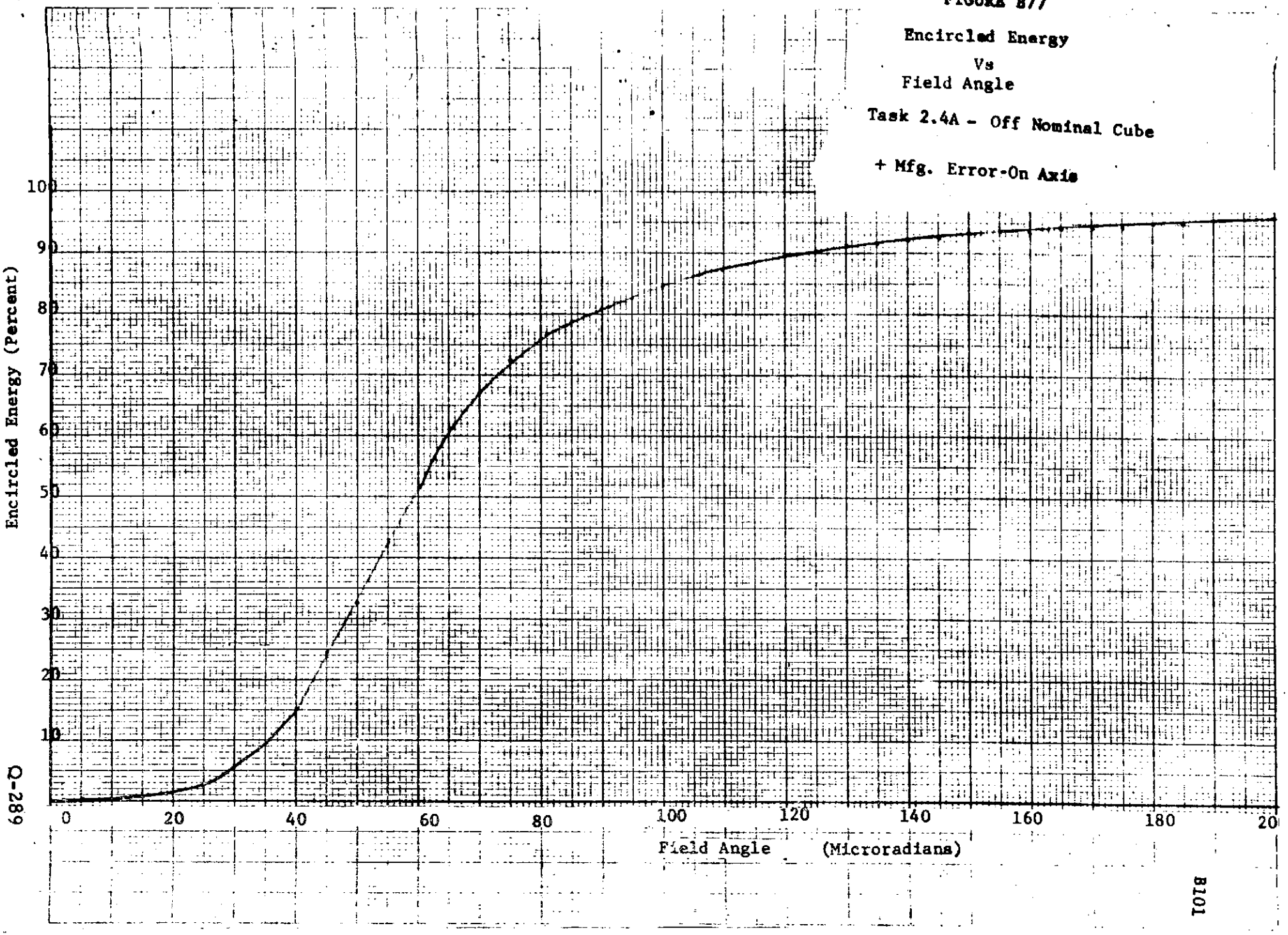
Encircled Energy

Vs

Field Angle

Task 2.4A - Off Nominal Cube

+ Mfg. Error-On Axis



B101

TABLE B24

ENCIRCLED ENERGY

Task 2.4A - Off Nominal Cube + Mfg. Error -15° Off Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1
10.00	0.5	0.6	0.2	0.5	0.5	0.5	0.3	0.7	0.7
15.00	1.7	1.9	0.9	1.8	1.0	1.9	1.2	2.2	2.1
20.00	3.4	3.6	2.4	3.5	1.9	3.5	2.9	4.2	4.0
25.00	5.4	5.5	5.5	5.9	5.1	5.9	6.3	6.6	6.3
30.00	8.6	8.7	8.8	9.1	9.4	8.9	9.8	10.0	9.7
35.00	13.7	13.7	12.6	13.6	13.9	13.4	13.7	14.8	14.6
40.00	19.5	19.4	18.2	19.9	18.5	19.7	19.6	20.7	20.4
45.00	25.3	25.2	25.5	26.4	25.7	26.3	26.9	26.8	26.6
50.00	32.2	32.1	32.6	33.2	34.0	33.0	34.4	34.5	34.2
55.00	39.5	39.4	40.1	41.0	43.3	40.8	42.6	42.0	41.8
60.00	46.8	46.7	48.0	49.5	50.8	49.3	50.8	49.2	49.3
65.00	54.4	54.2	56.0	57.3	58.1	57.3	58.5	56.2	56.7
70.00	61.7	61.4	63.0	63.5	64.8	63.9	64.7	62.8	63.5
75.00	67.9	67.8	69.1	69.2	71.5	69.7	70.2	68.5	69.1
80.00	72.8	72.8	74.5	74.4	76.3	74.6	74.8	73.1	73.6
85.00	76.8	76.9	78.7	78.6	79.8	78.6	78.8	77.1	77.3
90.00	80.3	80.3	81.3	81.3	82.3	81.3	81.4	80.4	80.5
95.00	82.8	82.9	83.3	83.3	83.9	83.3	83.4	82.9	82.8
100.00	84.5	84.6	84.9	84.9	85.1	84.9	84.8	84.6	84.5
105.00	85.8	85.9	86.1	86.1	86.2	86.1	86.0	85.9	85.7
110.00	86.9	87.0	87.1	87.1	87.2	87.1	87.1	87.0	86.9
115.00	87.9	88.0	88.0	88.0	88.2	88.1	88.1	88.0	88.0
120.00	88.8	88.9	88.9	88.9	89.1	89.0	89.0	88.9	88.9
125.00	89.6	89.6	89.7	89.7	90.0	89.8	89.8	89.6	89.6
130.00	90.3	90.3	90.4	90.5	90.6	90.5	90.4	90.3	90.3
135.00	90.9	90.9	90.9	91.0	91.1	91.0	91.1	91.0	91.0
140.00	91.4	91.4	91.4	91.5	91.5	91.5	91.6	91.5	91.5
145.00	91.8	91.8	91.8	91.9	91.9	91.9	92.0	91.9	91.9
150.00	92.3	92.2	92.3	92.4	92.3	92.3	92.4	92.3	92.3
155.00	92.7	92.7	92.7	92.7	92.7	92.7	92.7	92.7	92.7
160.00	93.1	93.1	93.1	93.1	93.1	93.1	93.0	93.1	93.1
165.00	93.5	93.5	93.6	93.5	93.5	93.5	93.5	93.4	93.4
170.00	93.8	93.8	93.9	93.9	93.9	93.9	93.8	93.8	93.8
175.00	94.2	94.2	94.2	94.2	94.3	94.2	94.2	94.1	94.2
180.00	94.5	94.5	94.5	94.6	94.6	94.6	94.6	94.5	94.5
184.99	94.8	94.8	94.7	94.8	94.8	94.8	94.8	94.9	94.9
189.99	95.1	95.1	95.1	95.1	95.2	95.1	95.2	95.1	95.2
194.99	95.3	95.3	95.4	95.4	95.4	95.4	95.4	95.4	95.4
199.99	95.6	95.7	95.7	95.6	95.7	95.7	95.7	95.7	95.6

TABLE B25

ENCIRCLED ENERGY

B103

Task 2.4A - Off Nominal Cube + Mfg. Error -15° Off Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.00	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1
6.00	0.1	0.1	0.1	0.2	0.3	0.2	0.1	0.1	0.1
8.00	0.3	0.4	0.2	0.4	0.3	0.3	0.2	0.5	0.5
10.00	0.5	0.6	0.2	0.5	0.5	0.5	0.3	0.7	0.7
12.00	1.2	1.3	0.4	1.0	0.5	1.0	0.5	1.5	1.5
14.00	1.2	1.3	0.8	1.5	0.7	1.5	1.1	1.5	1.5
16.00	2.1	2.3	1.1	2.1	1.0	2.1	1.4	2.7	2.5
18.00	2.6	2.7	1.7	2.7	1.9	2.7	2.2	3.2	3.0
20.00	3.4	3.6	2.4	3.5	1.9	3.5	2.9	4.2	4.0
22.00	3.8	4.0	3.6	4.4	3.5	4.4	4.2	4.8	4.5
24.00	5.0	5.1	4.1	5.0	4.5	4.9	4.8	6.1	5.8
26.00	5.7	5.8	5.7	6.2	6.5	6.1	6.5	6.9	6.6
28.00	7.3	7.3	7.3	7.7	7.2	7.6	8.2	8.6	8.3
30.00	8.6	8.7	8.8	9.1	9.4	8.9	9.8	10.0	9.7
32.00	11.2	11.2	10.0	10.7	10.8	10.5	11.1	12.5	12.3
34.00	11.8	11.8	12.1	12.9	12.2	12.6	13.4	13.1	12.9
36.00	14.9	14.8	13.8	15.1	14.6	14.9	15.1	16.0	15.9
38.00	16.7	16.6	15.9	17.2	16.9	17.0	17.2	17.9	17.7
40.00	19.5	19.4	18.2	19.9	18.5	19.7	19.6	20.7	20.4
42.00	21.3	21.9	21.3	22.5	21.4	22.7	22.7	22.3	22.0
44.00	24.1	24.1	22.9	24.4	24.2	24.3	24.5	25.5	25.2
46.00	26.6	26.5	26.8	27.7	28.1	27.6	28.4	28.4	28.1
48.00	29.2	29.2	29.8	30.8	29.7	30.7	31.9	31.2	30.8
50.00	32.2	32.1	32.6	33.2	34.0	33.0	34.4	34.5	34.2
52.00	35.2	35.2	35.3	36.1	37.3	35.9	37.7	37.8	37.4
54.00	37.2	37.1	38.8	39.4	40.6	39.1	41.1	39.8	39.6
56.00	40.7	40.6	42.2	43.3	44.1	43.0	44.9	43.3	43.1
58.00	43.9	43.7	44.6	45.8	47.6	45.5	47.1	46.5	46.4
60.00	46.9	46.7	48.0	49.5	50.8	49.3	50.8	49.2	49.3
62.00	49.3	49.1	51.3	52.7	53.6	52.6	53.8	51.6	51.8
64.00	53.4	53.1	53.5	55.1	56.7	55.1	56.4	55.1	55.6
66.00	56.1	55.9	57.3	58.4	60.0	58.6	59.7	57.8	58.3
68.00	59.0	58.7	60.0	61.0	61.5	61.3	62.1	60.4	61.0
70.00	61.7	61.4	63.0	63.5	64.8	63.9	64.7	62.8	63.5
72.00	64.5	64.3	65.2	65.6	67.8	66.0	66.8	65.3	66.0
74.00	66.1	65.9	68.2	68.3	70.2	68.7	69.3	67.0	67.7
76.00	68.9	68.8	70.7	70.5	72.4	71.0	71.3	69.5	70.0
78.00	71.0	71.0	72.2	72.1	74.5	72.5	72.9	71.4	71.9
80.00	72.8	72.6	74.5	74.4	76.3	74.6	74.8	73.1	73.6

FIGURE B78

Wavefront Map-0 Polarization

Task 2.4A - Off Nominal Cube + Mfg. Error -15° Off Axis

8104

MAP IN UNITS OF 0.01 WAVES

174 166 172 177

210 199 187 176 167 159 165 171 176 182 189 195

220 212 202 192 181 170 161 154 160 166 172 178 185 191 198 204

215 209 202 193 183 173 163 154 148 153 159 166 172 179 186 193 200 207

208 206 203 198 191 183 174 164 155 147 141 146 152 159 165 172 179 186 193 200 207 214

197 196 194 191 187 181 174 165 156 148 140 134 139 144 151 157 164 171 177 184 191 199 206 213

187 185 184 182 178 172 165 158 149 141 133 127 131 137 143 149 155 162 168 175 182 190 197 205

179 172 165 176 174 170 165 159 151 143 135 128 121 124 130 135 141 147 153 160 167 174 181 173 183 193

189 182 176 169 162 154 163 158 152 145 138 130 123 116 118 123 128 133 139 145 152 158 151 162 172 182 192 201

192 186 179 172 165 156 148 138 129 140 132 125 118 110 112 116 121 126 131 120 131 142 152 163 173 182 191 199

201 194 188 182 174 166 158 148 139 129 119 110 119 112 104 105 109 113 103 113 123 133 144 155 165 174 183 191 198 206

203 196 190 183 175 167 157 147 137 127 117 107 98 89 98 98 88 97 106 116 126 136 146 157 166 175 183 190 197 204

205 198 191 183 175 166 156 145 135 124 114 104 95 105 101 101 108 103 109 118 128 138 148 158 167 175 182 189 196 202

199 191 183 174 164 154 143 132 122 111 122 117 112 108 107 114 122 129 120 129 139 148 157 166 174 181 187 193

200 191 182 173 162 152 141 130 141 135 129 124 119 114 113 120 127 135 142 149 138 147 155 164 171 178 184 191

193 183 172 162 169 162 153 149 142 137 131 126 121 118 125 132 140 148 155 161 166 170 160 167 174 181

194 184 192 185 178 171 164 157 151 144 139 133 128 124 130 138 146 154 161 168 173 177 179 181 171 178

208 201 194 186 179 173 166 159 153 146 140 135 130 136 144 152 161 169 176 182 186 188 190 191

213 202 195 188 181 174 168 161 154 148 142 137 143 151 160 169 178 185 192 196 199 201

210 203 196 189 182 175 169 162 156 149 144 150 159 168 178 187 196 203 208 212

209 202 195 189 182 175 169 162 156 151 157 166 176 187 197 207 214 220

199 193 186 180 174 168 162 156 164 173 184 195 206 216

190 184 179 173 168 162 169 179 193 202

FIGURE B79

Wavefront Plot-Q Polarization

Task 2.4A - Off Nominal Cube + Mfg. Error -15° Off Axis

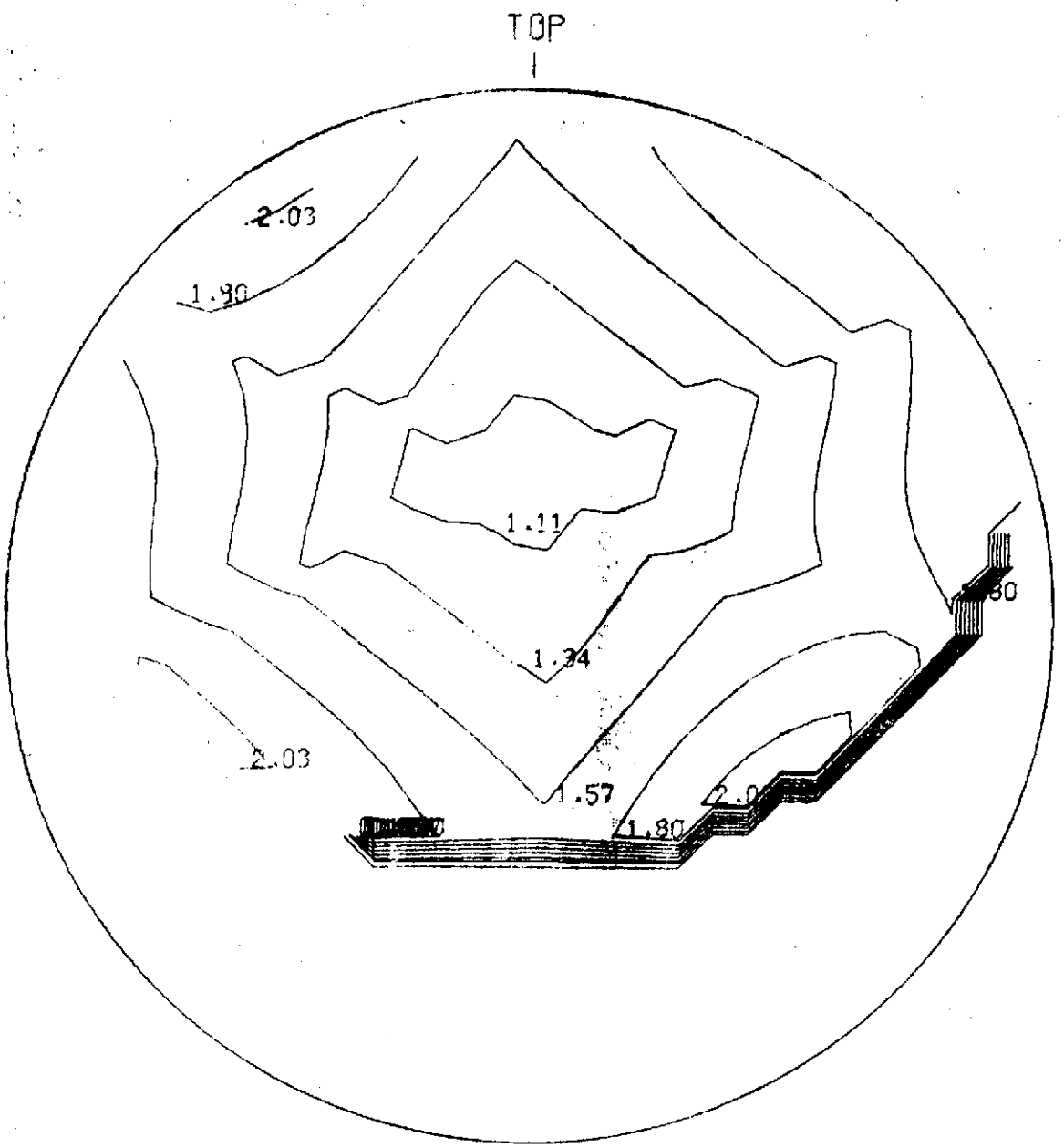


FIGURE B80

Wavefront Map-P Polarization

Task 2.4A – Off Nominal Cube + Mfg. Error –15° Off Axis **B106**

MAP IN UNITS OF .001 WAVES

```
                                                  143 135  -7  -2
                                          180 168 157 146 136 128 -14  -9  -3   2   8  14
                                      190 182 172 161 150 139 130 123 -20 -14  -8  -2   4  11  17  24
                                  184 179 171 162 152 142 132 124 117 -26 -20 -14  -7   0   5  12  19  26
                              178 175 172 167 161 152 143 134 125 117 110 -33 -27 -21 -14  -8  -1   5  12  19  26  34
                          167 165 163 161 156 150 143 135 126 117 109 103 -41 -35 -29 -23 -16  -9  -2   4  11  18  25  33
                          156 155 153 151 147 142 135 127 119 110 103  96 -48 -43 -37 -31 -24 -18 -11  -4   2   9  16  24
                      195 189 182 176 143 139 134 128 121 113 105  97  91 -55 -50 -44 -39 -33 -26 -20 -13  -6   1  47  53  63
                  205 199 192 185 178 170 133 128 122 115 107 100  92  85 -62 -57 -52 -46 -41 -35 -28 -21  18  29  39  49  59  68
                  208 202 196 189 181 173 164 158 145 109 102  94  87  80 -68 -64 -59 -54 -48 -12  -1   9  19  30  40  49  58  66
              218 211 205 198 191 183 174 165 155 145 135 126  88  81  74 -75 -71 -66 -29 -19  -9   0  11  22  32  41  50  58  65  73
              220 213 206 199 192 183 174 164 154 144 134 124 115 106  67 -82 -44 -35 -26 -16  -6   3  13  24  33  42  50  57  64  71
              221 214 207 199 191 182 172 162 151 141 131 121 112 -65 -69  80  87 -32 -23 -14  -4   5  15  25  34  42  49  56  63  69
              215 207 199 190 180 173 159 149 138 128 -49 -54 -58 -62  86  93 101 108 -12  -3   6  15  24  33  41  48  54  60
              216 208 199 189 179 168 157 146 -30 -36 -41 -46 -51 -56  91  99 106 114 121 128   5  14  22  31  38  45  51  58
                  209 199 189 178  -1  -8 -15 -22 -28 -34 -39 -44 -49  97 104 111 119 127 134 140 146 149  27  34  41  48
                  211 200  21  14   6   0  -7 -13 -20 -26 -32 -37 -43 102 109 116 125 133 140 147 152 156 158 160  38  49
                      37  30  22  15   8   1  -5 -11 -18 -24 -30 -36 109 115 123 131 140 148 155 160 164 167 169 170
                      38  31  24  17  10   3  -3 -10 -16 -22 -28 116 122 130 138 148 156 164 170 175 178 180
                          39  32  25  18  11   4  -2  -8 -15 -21 123 129 137 147 157 166 175 182 187 191
                          30  31  24  17  11   4  -2  -8 -14 129 136 145 155 166 176 185 193 199
                              28  22  15   9   3  -2  -8 135 142 152 162 174 185 195
                                  19  13   8   2  -2 140 146 151 159 181
```

FIGURE B81

Wavefront Plot-P Polarization

Task 2.4A - Off Nominal Cube + Mfg. Error -15° Off Axis

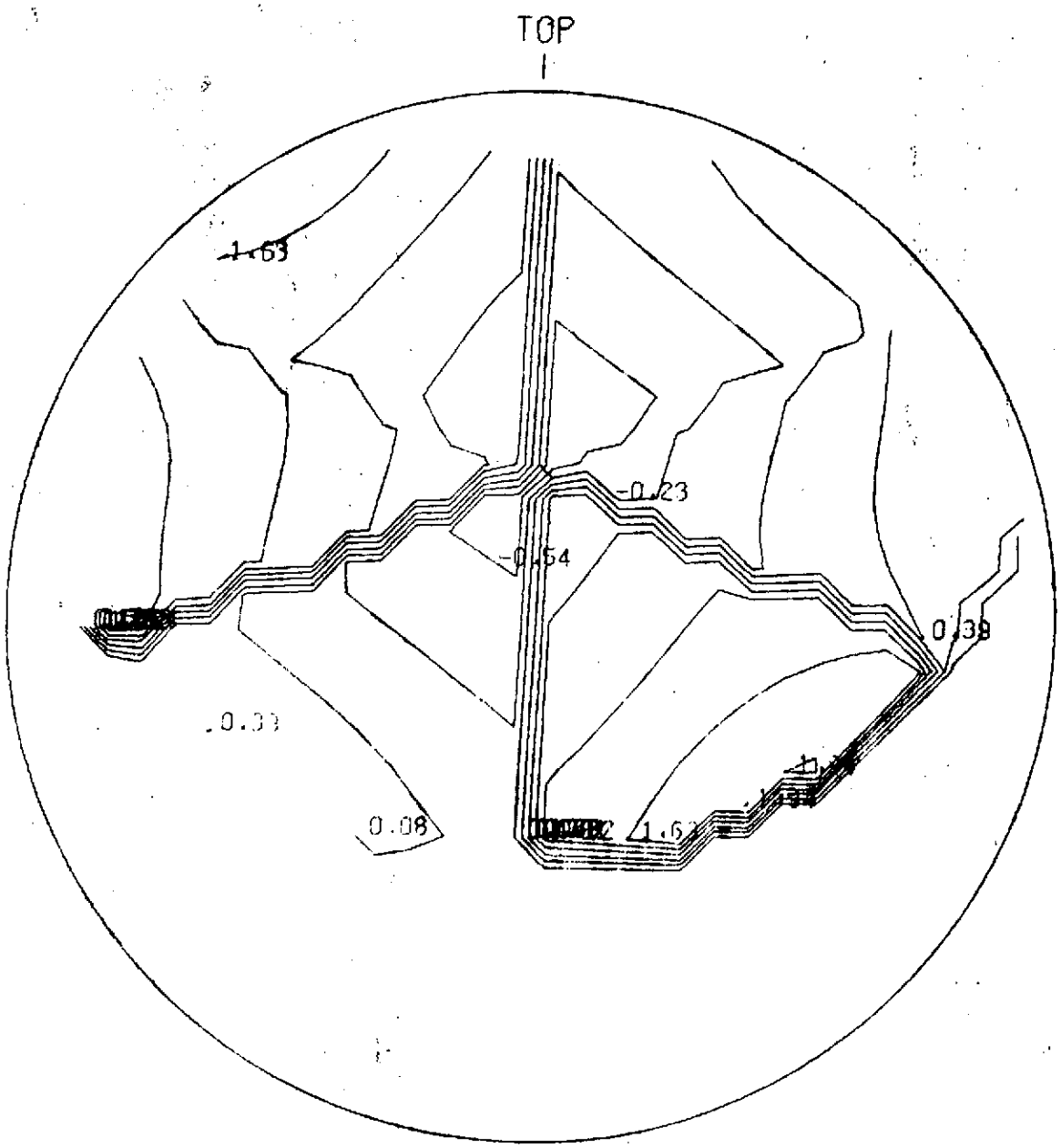


FIGURE B02

Task 2.4A - Off Nominal Cube + Mfg. Error -15° Off Axis

PRINTER MAP OF POINT SPREAD FUNCTION

B108

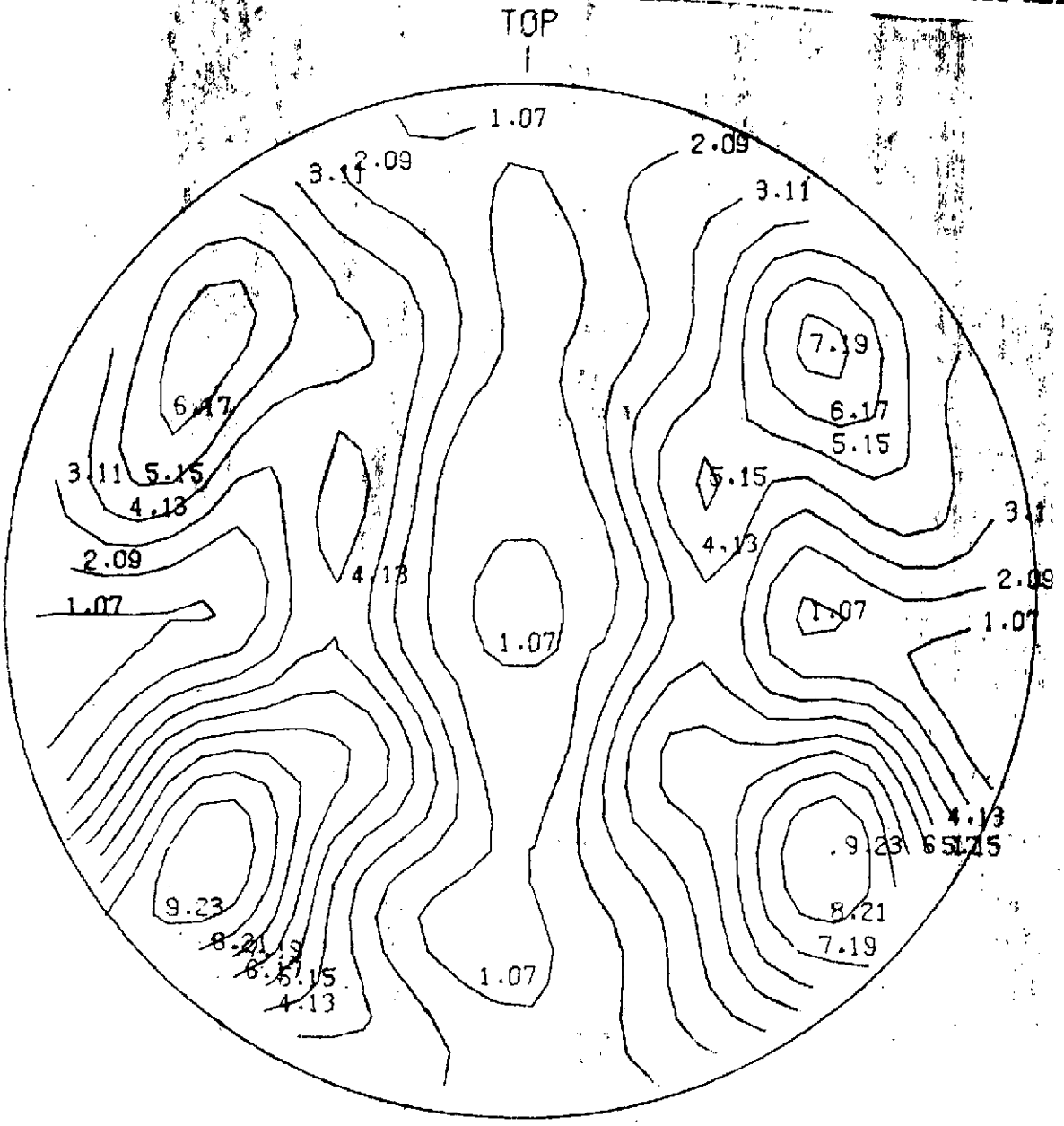
(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0156 = 100
TOTAL ENERGY = 0.1873400D+01
MAP REPRESENTS 0.1737443D+01 OR 92.8915 PERCENT OF TOTAL ENERGY

```
                                                
```

FIGURE B83

Intensity Distriubtion - Central 129 Microradians

Task 2.4A - Off Nominal Cube + Mfg. Error -15° Off Axis



REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

FIGURE B84

Encircled Energy
Vs
Field Angle
Task 2.4A - Off Nominal Cube
+ Mfg. Error -15° Off Axis

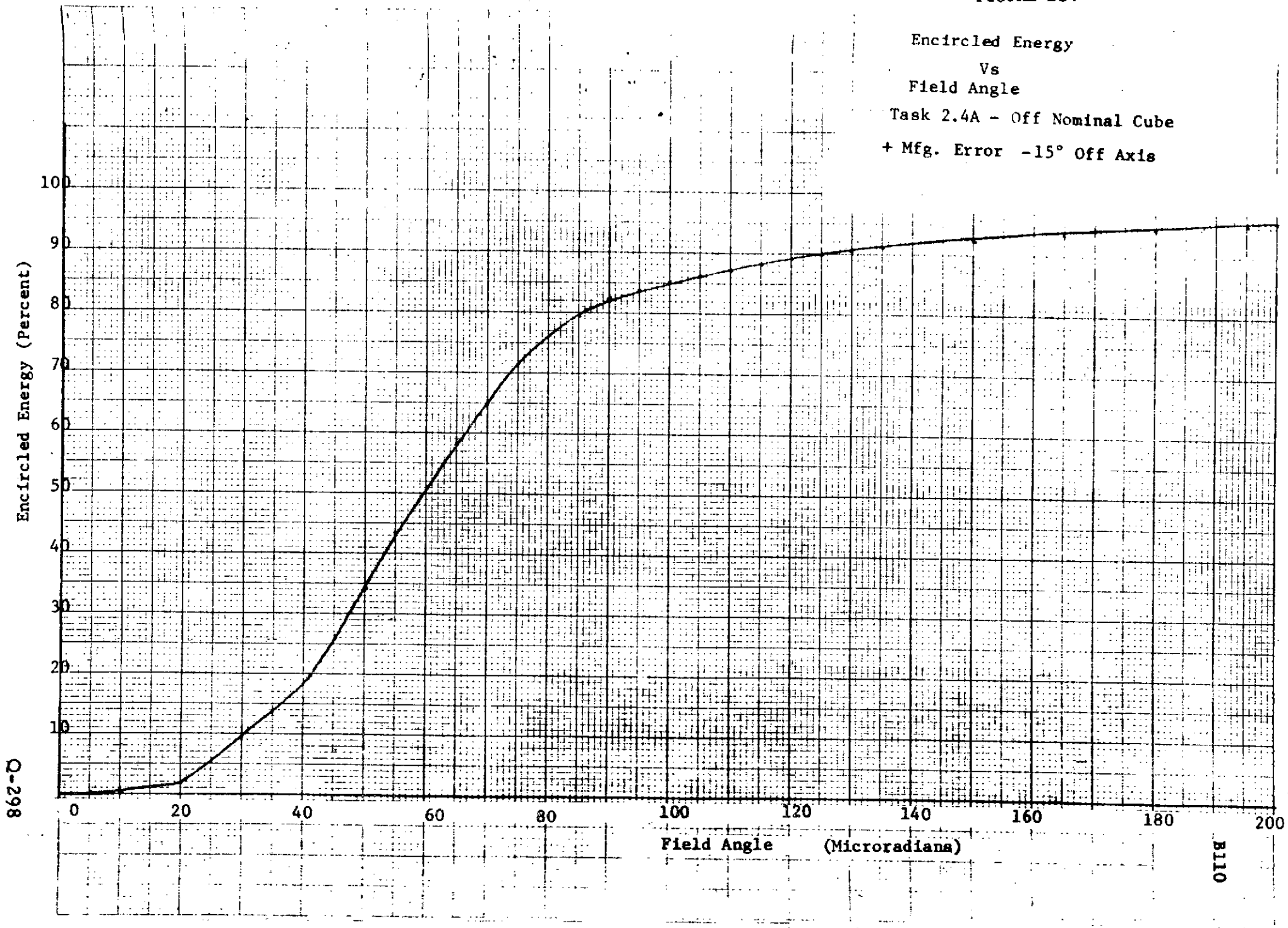


TABLE B26

ENCIRCLED ENERGY

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature-On Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.00	0.1	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.1
6.00	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1
8.00	0.3	0.2	0.1	0.4	0.2	0.3	0.2	0.2	0.3
10.00	0.4	0.3	0.2	0.5	0.4	0.5	0.3	0.3	0.4
12.00	0.8	0.7	0.4	0.7	0.5	0.7	0.5	0.7	0.8
14.00	0.8	0.7	0.7	0.9	0.7	0.9	0.8	0.7	0.8
16.00	1.4	1.2	0.9	1.2	0.9	1.2	1.0	1.2	1.2
18.00	1.7	1.4	1.3	1.4	1.5	1.4	1.3	1.4	1.5
20.00	2.3	2.1	2.0	1.9	1.5	1.9	1.9	2.1	2.1
22.00	2.6	2.4	2.6	2.2	2.2	2.2	2.4	2.4	2.5
24.00	3.6	3.4	3.2	2.8	2.5	2.8	3.1	3.5	3.5
26.00	4.2	4.0	4.1	3.4	3.4	3.3	3.9	4.1	4.2
28.00	5.8	5.7	5.5	4.5	3.6	4.4	5.5	5.9	5.9
30.00	6.8	6.7	6.4	5.5	5.0	5.4	6.5	7.0	7.0
32.00	9.0	9.0	7.9	6.6	5.7	6.5	8.2	9.5	9.3
34.00	9.6	9.6	9.4	8.5	7.6	8.3	10.0	10.1	9.9
36.00	12.1	12.2	11.2	10.0	9.2	9.8	12.1	12.9	12.5
38.00	13.5	13.4	13.1	12.3	12.4	12.0	14.1	14.4	14.0
40.00	16.2	16.0	15.4	14.3	13.9	14.0	16.6	17.2	16.9
42.00	17.4	17.2	18.2	17.5	18.2	17.2	19.4	18.5	18.2
44.00	20.8	20.4	20.6	19.6	20.2	19.2	21.9	22.0	21.8
46.00	23.2	22.8	23.6	23.7	24.8	23.3	25.0	24.5	24.3
48.00	26.7	26.3	27.5	27.2	26.2	26.8	28.8	28.2	27.9
50.00	29.7	29.3	29.9	30.3	30.9	30.0	31.4	31.3	31.0
52.00	33.8	33.3	33.7	33.9	33.6	33.6	35.1	35.3	35.1
54.00	36.0	35.6	36.6	37.7	38.4	37.4	38.4	37.5	37.2
56.00	40.1	39.8	41.1	41.5	41.4	41.4	42.8	41.6	41.3
58.00	43.1	43.0	43.9	44.6	46.6	44.4	45.8	44.6	44.3
60.00	46.6	46.6	47.9	48.3	50.2	48.3	49.5	48.1	47.8
62.00	49.0	49.0	51.3	52.4	54.4	52.4	52.8	50.3	50.1
64.00	53.2	53.3	54.3	55.2	57.7	55.2	55.7	54.4	54.4
66.00	55.7	55.8	57.9	59.4	61.6	59.4	59.0	56.8	56.9
68.00	59.5	59.7	61.0	61.9	63.5	62.0	61.6	60.4	60.5
70.00	61.9	61.9	63.8	65.1	66.7	65.2	64.3	62.5	62.7
72.00	65.2	65.3	66.3	67.4	69.2	67.5	66.6	65.7	65.9
74.00	67.0	67.1	69.1	69.9	71.5	70.1	69.1	67.3	67.5
76.00	69.9	70.0	71.5	71.8	73.2	72.0	71.5	70.2	70.2
78.00	71.7	71.8	72.9	73.4	75.2	73.6	73.0	71.8	71.9
80.00	73.7	73.8	74.9	75.1	76.5	75.3	75.1	73.8	73.9

TABLE B27

ENCIRCLED ENERGY

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature-On Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.1	0.1	0.0	0.2	0.1	0.2	0.1	0.1	0.1
10.00	0.4	0.3	0.2	0.5	0.4	0.5	0.3	0.3	0.4
15.00	1.2	1.0	0.8	1.1	0.9	1.1	0.9	1.0	1.0
20.00	2.3	2.1	2.0	1.9	1.5	1.9	1.9	2.1	2.1
25.00	4.0	3.8	3.9	3.3	2.9	3.2	3.7	3.9	4.0
30.00	6.8	6.7	6.4	5.5	5.0	5.4	6.5	7.0	7.0
35.00	11.0	11.0	10.2	9.0	8.7	8.8	10.9	11.7	11.4
40.00	16.2	16.0	15.4	14.3	13.9	14.0	16.6	17.2	16.9
45.00	22.0	21.7	22.2	22.3	23.0	21.8	23.6	23.4	23.1
50.00	29.7	29.3	29.9	30.3	30.9	30.0	31.4	31.3	31.0
55.00	38.7	38.3	39.2	39.6	40.7	39.4	40.8	40.1	39.9
60.00	46.6	46.6	47.9	48.3	50.2	48.3	49.5	48.1	47.8
65.00	54.4	54.5	56.5	57.7	60.0	57.7	57.7	55.5	55.5
70.00	61.8	61.9	63.8	65.1	66.7	65.2	64.3	62.5	62.7
75.00	68.6	68.8	70.3	70.9	72.4	71.1	70.4	69.0	69.0
80.00	73.7	73.8	74.9	75.1	76.5	75.3	75.1	73.8	73.9
85.00	77.4	77.3	78.5	78.8	79.7	78.8	78.8	77.4	77.7
90.00	80.4	80.1	80.9	81.4	81.8	81.3	81.1	80.3	80.7
95.00	83.0	82.6	83.0	83.3	83.5	83.3	83.1	82.7	83.1
100.00	84.7	84.4	84.7	84.9	85.0	84.9	84.7	84.4	84.8
105.00	86.0	85.8	86.2	86.3	86.5	86.4	86.2	85.9	86.1
110.00	87.2	87.3	87.4	87.5	87.8	87.6	87.5	87.4	87.3
115.00	88.3	88.6	88.6	88.6	88.9	88.6	88.7	88.7	88.4
120.00	89.3	89.7	89.6	89.6	89.8	89.6	89.7	89.6	89.3
125.00	90.1	90.5	90.5	90.4	90.6	90.5	90.5	90.5	90.1
130.00	90.9	91.2	91.2	91.2	91.3	91.2	91.2	91.2	90.9
135.00	91.8	91.7	91.8	91.8	91.9	91.7	91.8	91.7	91.7
140.00	92.3	92.2	92.3	92.4	92.4	92.4	92.3	92.2	92.2
145.00	92.7	92.7	92.8	92.8	92.8	92.8	92.8	92.7	92.7
150.00	93.1	93.1	93.2	93.2	93.3	93.2	93.2	93.2	93.1
155.00	93.5	93.5	93.6	93.5	93.7	93.5	93.6	93.5	93.5
160.00	93.9	93.9	93.9	93.9	93.9	93.9	93.9	93.9	93.9
165.00	94.2	94.2	94.2	94.3	94.2	94.2	94.2	94.2	94.2
170.00	94.5	94.5	94.6	94.5	94.5	94.5	94.5	94.5	94.5
175.00	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8
180.00	95.1	95.1	95.1	95.1	95.2	95.1	95.1	95.1	95.1
184.99	95.4	95.4	95.4	95.4	95.4	95.4	95.4	95.4	95.4
189.99	95.6	95.6	95.6	95.7	95.7	95.7	95.7	95.6	95.7
194.99	95.9	95.9	95.9	95.9	96.0	95.9	95.9	95.9	95.9
199.99	96.1	96.2	96.1	96.2	96.2	96.2	96.1	96.2	96.2

Wavefront Map-0 Polarization

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature-On Axis

MAP IN UNITS OF 0.01 WAVES

```
                                                  152 143 136 130 124 136 139 140 141 145
                                          171 162 153 143 136 129 122 116 132 135 136 137 141 148 157 165
                                      169 161 152 143 136 129 123 116 110 123 127 129 131 135 142 150 157 161
                                  166 159 151 142 134 127 122 117 111 104 111 116 119 122 127 134 140 145 148 150
                              159 155 148 139 131 123 118 114 111 106  99  98 105 109 113 118 125 129 133 134 136 137
                          149 148 143 136 127 119 112 109 107 104 100  93  87  93  99 105 110 116 120 122 123 124 126 129
                      139 138 136 131 123 114 106 102 100 100  97  93  86  76  83  90  97 104 109 112 113 114 115 117 121 125
                  299 131 129 126 120 111 102  95  92  92  92  90  85  79  68  74  82  89  96 101 104 105 106 107 109 113 117 297
                  298 292 286 116 109 100  90  84  82  83  84  82  77  70  60  66  72  79  85  90  93  96  97  99 101 280 291 299
                  299 292 286 278 101  90  80  74  73  74  76  74  69  61  53  57  61  66  71  76  81  85  88  91 269 282 292 301
              310 302 293 284 275 266 257  72  65  63  64  66  64  59  51  45  48  50  53  57  62  68  74 246 258 271 283 295 305 311
              313 304 293 282 271 262 254 246 237  54  54  56  53  48  41  36  38  39  40  43  49 229 238 245 260 271 284 297 308 316
              317 306 293 279 268 259 253 245 237 228 222  42  40  37  31  26  28  28  28 219 227 235 243 252 262 272 284 297 309 320
              320 308 293 279 266 258 252 246 238 230 224 219  30  27  23  16  17  18 214 223 231 239 247 255 262 271 282 296 310 322
              322 309 295 280 267 259 253 247 240 232 225 218 210 199  14   5 192 206 216 225 233 241 248 255 261 270 281 296 311 323
              323 311 296 281 270 261 255 248 241 233 225 216 206 192   5  14 199 210 218 225 232 240 247 253 259 267 280 295 309 322
              322 310 296 282 271 262 255 247 239 231 223 214  18  17  16  23  27  30 219 224 230 238 246 252 258 266 279 293 308 320
              320 309 297 284 272 262 252 243 235 227 219  28  28  28  26  31  37  40  42 222 228 237 245 253 259 268 279 293 306 317
              316 308 297 284 271 260 249 238 229  49  43  40  39  38  36  41  48  53  54  54  54 237 246 254 262 271 282 293 304 313
              311 305 295 283 271 258 246  74  68  62  57  53  50  48  45  51  59  64  66  64  63  65  72 257 266 275 284 293 302 310
                  301 292 282 269  91  88  85  81  76  71  66  61  57  53  61  69  74  76  74  73  74  80  90 101 278 286 292 299
                  299 291 280 101  99  97  96  93  90  85  79  72  66  60  70  77  82  84  83  82  84  90 100 109 116 286 292 298
                  297 117 113 109 107 106 105 104 101  96  89  82  74  68  79  85  90  92  92  92  95 102 111 120 126 129 131 299
                      125 121 117 115 114 113 112 109 104  97  90  83  76  86  93  97 100 100 102 106 114 123 131 136 138 139
                          129 126 124 123 122 120 116 110 105  99  93  87  93 100 104 107 109 112 119 127 136 143 148 149
                              137 136 134 133 129 125 118 113 109 105  98  99 106 111 114 118 123 131 139 148 155 159
                                  150 148 145 140 134 127 122 119 116 111 104 111 117 122 127 134 142 151 159 166
                                      161 157 150 142 135 131 129 127 123 118 116 123 129 136 143 152 161 169
                                          165 157 148 141 137 136 135 132 116 122 129 136 143 153 162 171
                                                  145 141 140 139 136 126 130 136 143 152
```

1						
NONE	RMS	0.86	PK-PK	3.19	FRED	WAVEFRONT

FIGURE B86

Wavefront Plot-Q Polarization

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature-On Axis

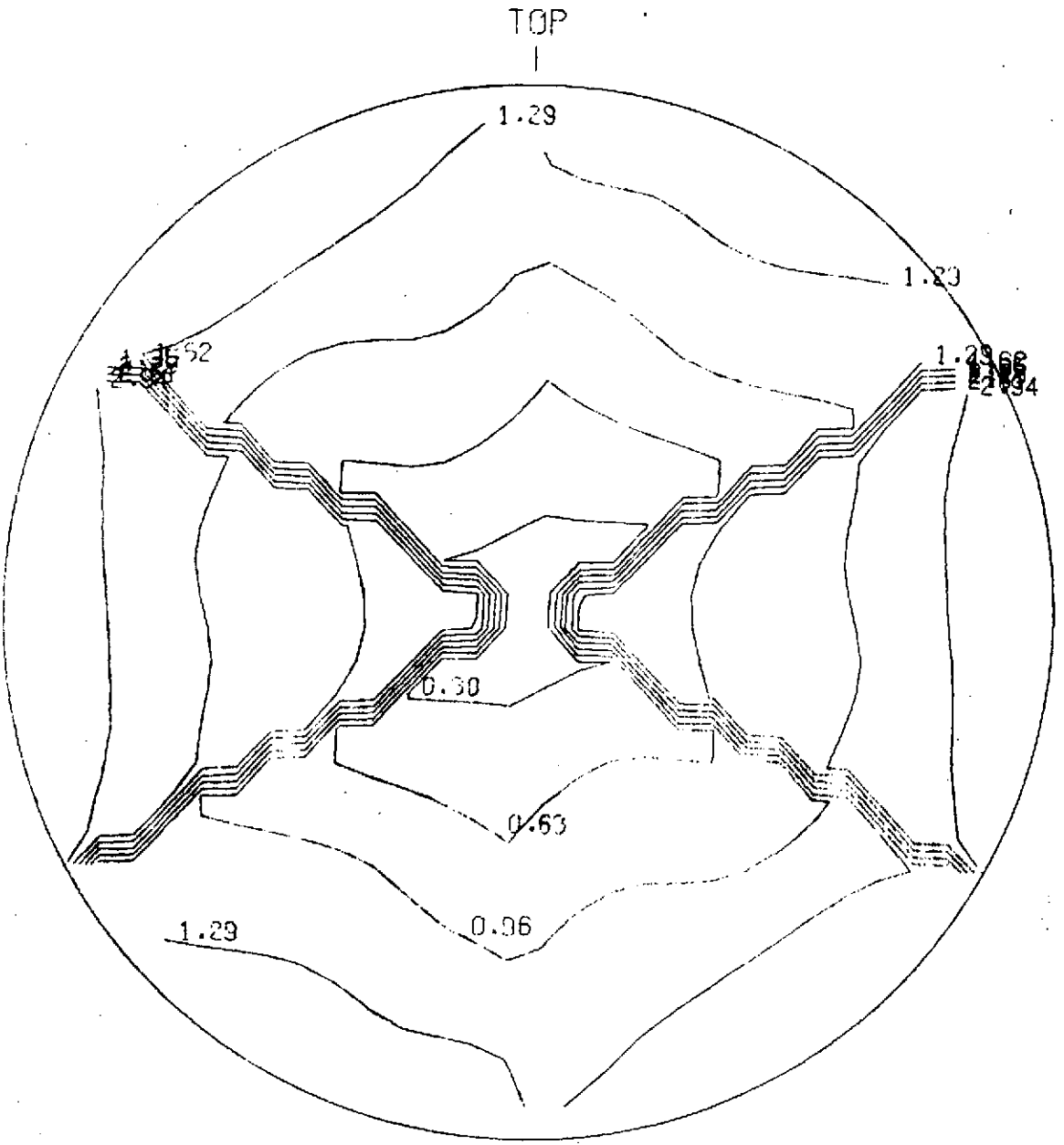


FIGURE B87

Wavefront Map-P Polarization

Task 2.482 - Off Nominal Cube + Mfg. Error + First Temperature-On Axis

B115

MAP IN UNITS OF 0.01 WAVES

```
                                  310 302 295 288 282 144 147 148 149 153
                              330 320 311 302 295 287 281 274 140 143 144 145 149 156 165 174
                          328 320 311 302 294 287 281 275 268 132 136 137 139 143 150 158 165 170
                      325 317 309 301 292 285 280 275 270 263 120 125 128 131 136 142 149 153 157 158
                  318 313 306 298 289 282 276 273 269 264 258 107 113 118 122 127 133 138 141 143 144 146
              308 306 302 294 285 277 271 267 265 263 258 252  95 102 107 113 119 124 128 130 131 133 135 137
          297 297 295 290 282 273 265 260 258 258 256 251 245  85  92  99 106 112 117 120 121 122 123 126 129 133
      315 289 287 284 278 269 260 253 250 250 251 249 244 237  76  83  90  98 104 109 112 113 114 115 118 122 126 163
      314 308 302 295 288 258 249 243 241 242 243 241 236 229  69  74  81  87  94  98 102 104 106 108 110 146 157 165
      315 308 302 294 259 249 239 232 231 233 234 232 227 219  61  66  70  75  80  85  89  93  97 100 135 148 158 167
  326 319 309 300 291 282 273 230 224 222 223 224 222 217 209  53  56  58  61  65  70  76  83 112 124 136 145 161 171 177
  329 320 309 298 287 278 270 262 253 212 212 213 211 206 199  45  46  47  48  52  57  95 104 115 126 137 150 163 174 182
  333 322 309 295 284 275 269 261 253 244 238 200 199 195 190  35  36  36  37  85  92 101 109 118 128 138 150 163 175 186
  336 324 309 295 282 274 268 262 254 246 240 235 188 185 181  24  26  26  80  89  97 105 113 120 128 137 148 162 176 188
  338 325 310 296 283 275 269 263 256 248 241 234 226 215 172  13  58  72  82  91  99 107 114 121 127 135 147 161 177 189
  339 327 311 297 285 277 271 264 257 249 241 232 222 208  25 184  65  76  84  91  98 106 113 119 125 133 146 160 175 188
  338 326 312 298 287 278 270 263 255 247 239 230  38  37  36 193 197 200  85  90  96 104 112 118 124 132 145 159 174 186
  336 325 313 300 288 278 268 259 251 242 235  49  48  48  47 202 207 211 212  88  94 103 111 119 125 134 145 159 172 183
  332 324 313 300 287 276 265 254 245  69  63  60  59  58  56 211 218 223 224 224 224 103 112 120 128 137 148 159 170 179
  327 321 311 299 286 274 262  94  88  82  77  73  70  68  65 221 229 234 236 235 234 235 242 123 132 141 150 159 168 176
      317 309 298 285 111 108 105 101  96  91  86  81  77  73 231 239 244 246 245 243 244 251 260 271 144 152 158 165
      315 307 296 121 119 117 116 113 110 105  99  92  86  80 240 248 253 255 254 253 254 261 270 280 287 152 158 164
      313 137 133 129 127 126 125 124 121 116 109 102  94  88 249 256 260 262 262 262 265 272 281 290 296 299 301 165
          145 141 137 135 134 133 132 129 124 117 110 103  96 257 263 268 270 270 272 277 284 294 302 307 308 309
              149 146 144 143 142 140 136 130 125 119 113 107 264 270 274 277 279 283 289 297 306 313 318 319
                  157 156 154 153 149 145 138 133 129 125 118 269 276 281 284 288 294 301 310 318 325 329
                      170 168 165 160 154 147 142 139 137 131 275 281 287 292 297 304 312 321 329 336
                          182 177 170 162 159 151 149 147 143 280 287 293 299 306 314 322 331 340
                              185 177 168 161 157 156 155 152 286 293 299 306 314 323 332 341
                                  165 161 160 159 156 294 300 306 314 322
```

Q-303

ADD	ON AXIS	AVERAGE	AVERAGE	AVERAGE	TEMPERAT
1					
NONE	RMS	0.85	PK-PK	3.28	FRED	WAVEFRONT

FIGURE B88

Wavefront Plot-P Polarization

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature-On Axis

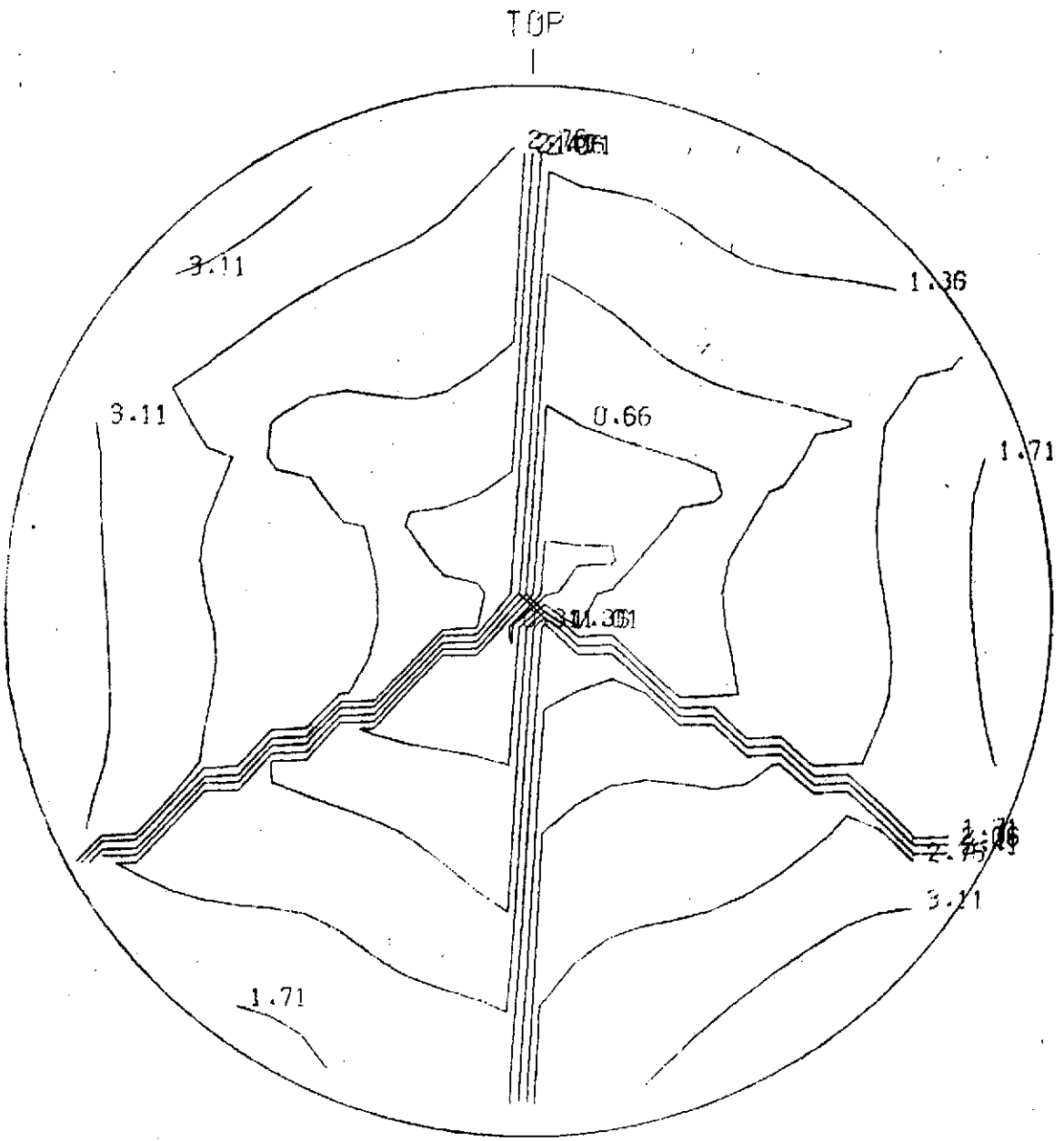


FIGURE 309

Task 2.482 - Off Nominal Cube + Mfg. Error + First Temperature-On Axis

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0176 = 100 8217
TOTAL ENERGY = 0.2461000D+01
MAP REPRESENTS 0.2307655D+01 OR 93.7690 PERCENT OF TOTAL ENERGY

```
 1  1  1  1  0  0  1  2  1  0  0  1  1  1  1  1  0  1  0  1  2  2  1  1  1  1  1  1  0  0  1  1  1  1  1
 1  1  1  1  0  0  1  1  1  1  0  0  1  1  1  3  3  1  0  1  2  4  4  2  0  1  1  1  1  1  0  0  1  1  1
 0  1  1  0  1  1  1  1  1  1  0  1  1  1  3  4  2  2  2  2  2  3  3  1  1  1  1  1  1  0  0  0  1  1  1
 0  0  1  1  0  1  1  1  2  2  1  1  1  1  2  3  4  4  2  1  1  2  2  1  1  1  1  1  1  1  0  1  1  1  0
 0  0  0  1  0  0  0  1  3  3  3  2  2  1  2  4  5  4  3  2  2  2  2  2  2  1  1  1  1  1  1  1  0  0  0
 0  0  0  1  1  1  1  2  4  6  5  4  3  2  4  8 12 13  8  5  3  1  3  2  2  2  0  1  1  1  1  1  1  0  0
 0  0  1  1  2  2  2  4  8  8  7  7  5  3  5  6 16 20  9  6  6  2  3  2  1  1  0  1  1  1  1  1  1  0  0
 1  0  0  1  2  2  3  7 10  8  9 10  6  7  8  7 14 18 12 13 14  7  4  4  1  0  1  1  1  1  1  1  1  0  0
 1  0  1  1  1  2  3  5  6  8 12  9 11 19 19 22 24 21 24 31 32 24 12  5  1  1  2  2  1  1  1  0  1  1  1
 1  1  1  1  2  3  3  1  2  6 10 15 28 37 39 46 49 44 45 51 49 39 27 14  4  3  4  2  2  2  1  0  1  1  1
 1  1  0  1  3  4  4  2  1  1 12 29 36 44 62 61 56 57 61 77 72 45 31 20 10  6  4  2  2  2  1  1  1  0  1
 1  1  2  3  3  4  5  4  3  6 20 35 43 66 82 62 62 74 61 76 91 67 41 26 16  8  5  5  3  2  1  2  3  2  1
 1  2  3  2  2  4  5  5  5  9 19 27 51 81 75 56 81100 71 58 73 63 36 27 18  7  6  7  4  1  1  2  2  2  1
 1  1  1  1  3  4  4  5  7  9 20 23 34 54 50 43 48 53 48 41 45 39 24 25 18  8  9  4  3  2  2  3  1  1  1
 1  1  0  3  4  4  2  6 13 13 24 27 21 29 38 30 15 13 21 23 21 26 30 29 22 19 17  5  3  4  4  3  0  1  1
 1  1  1  4  5  6  4  7 17 21 29 28 19 17 25 17  4  7 12 17  4 15 32 22 25 25 20 11  5  5  4  4  2  1  0
 1  1  2  5  6  8  7  7 14 29 38 29 31 23 26 26  9  4  3 18 15 40 50 21 32 27 17 16  8  5  5  6  4  2  1
 1  2  3  6  6  7  6 10 12 30 42 33 54 39 20 25 15 18 15 19 25 53 55 29 41 26 12 12  7  8  6  6  3  2  1
 1  2  3  5  4  5  5 14 17 29 47 39 50 31  4 12  3  6 14 18 16 23 28 40 53 29 14  6  4  9  6  5  1  1  2
 0  1  2  3  2  4  4 13 21 23 33 25 21 14  5 18 14  8 10 12 10  5  6 26 37 26 21  7  2  4  3  4  1  0  1
 0  1  1  3  1  3  4  7 15  8 11 15 21 34 31 23 18 12 14 26 35 25  9  8  8 10 18  9  3  2  2  4  2  1  0
 0  1  2  4  1  1  2  1  4  1 13 31 41 60 67 56 51 52 53 59 70 64 44 29 11  1  4  5  6  5  2  2  1  1  1
 1  1  1  2  1  1  1  2  4  7 21 39 50 64 75 74 83100 90 71 77 82 66 44 23  8  3  1  4  4  2  1  1  1  1
 2  2  2  1  0  1  2  6 12 15 20 31 53 79 93 85 72 74 73 77 88 78 54 35 24 15  7  2  1  2  3  4  2  1  1
 1  1  2  1  1  2  3  6  9 10 10 18 38 65 88 89 70 58 61 77 81 60 38 22 11  5  3  2  1  1  2  2  1  1  0
 1  0  0  0  1  3  4  3  3  2  2 10 22 35 45 46 45 46 46 44 42 37 28 14  5  3  3  3  3  2  1  0  0  0  1
 1  0  1  1  1  3  2  1  1  1  1  5 12 21 27 28 24 21 23 21 19 19 14 12 12 10  9  8  7  4  1  1  0  0  1
 0  0  1  1  1  1  0  0  1  1  3  4  4  7 15 21 20 18 17 14 11  7  6 10 12 11 13 11  7  4  2  1  0  0  1
 0  0  1  1  1  1  1  1  0  2  3  4  3  3  4  6 13 21 16  7  4  3  4  7  8  8  8  5  3  2  2  1  0  0  0
 0  0  0  1  1  2  2  1  1  1  1  2  2  1  2  3  7 13 11  6  4  2  3  5  5  4  2  0  0  1  1  1  0  0  0
 0  0  1  1  1  1  2  1  1  1  1  1  1  1  2  3  3  4  5  6  4  2  2  2  2  2  2  1  1  1  1  1  1  1  0
 1  1  1  1  0  0  1  1  2  1  1  1  2  3  3  2  3  4  4  3  2  1  1  0  1  1  2  1  1  1  1  1  1  1  0
 1  1  1  1  0  0  1  1  2  2  1  2  3  2  2  2  2  2  2  3  2  1  1  0  0  1  2  1  1  1  0  1  1  1  0
 1  1  1  1  1  1  1  1  1  1  1  1  1  2  2  3  2  1  0  1  3  3  1  1  0  0  1  1  1  0  0  0  1  1  1
 0  1  1  1  1  0  1  1  1  1  1  1  1  1  2  2  1  1  1  0  1  2  1  1  0  0  0  0  1  1  0  1  1  2  1  1
```

10
10

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

10
10
NONE RMS 2.4% PK-PK 8.70 FREQ WAVEFRONT

FIGURE B90

Intensity Distriubtion - Central 129 Microradians

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature-On Axis

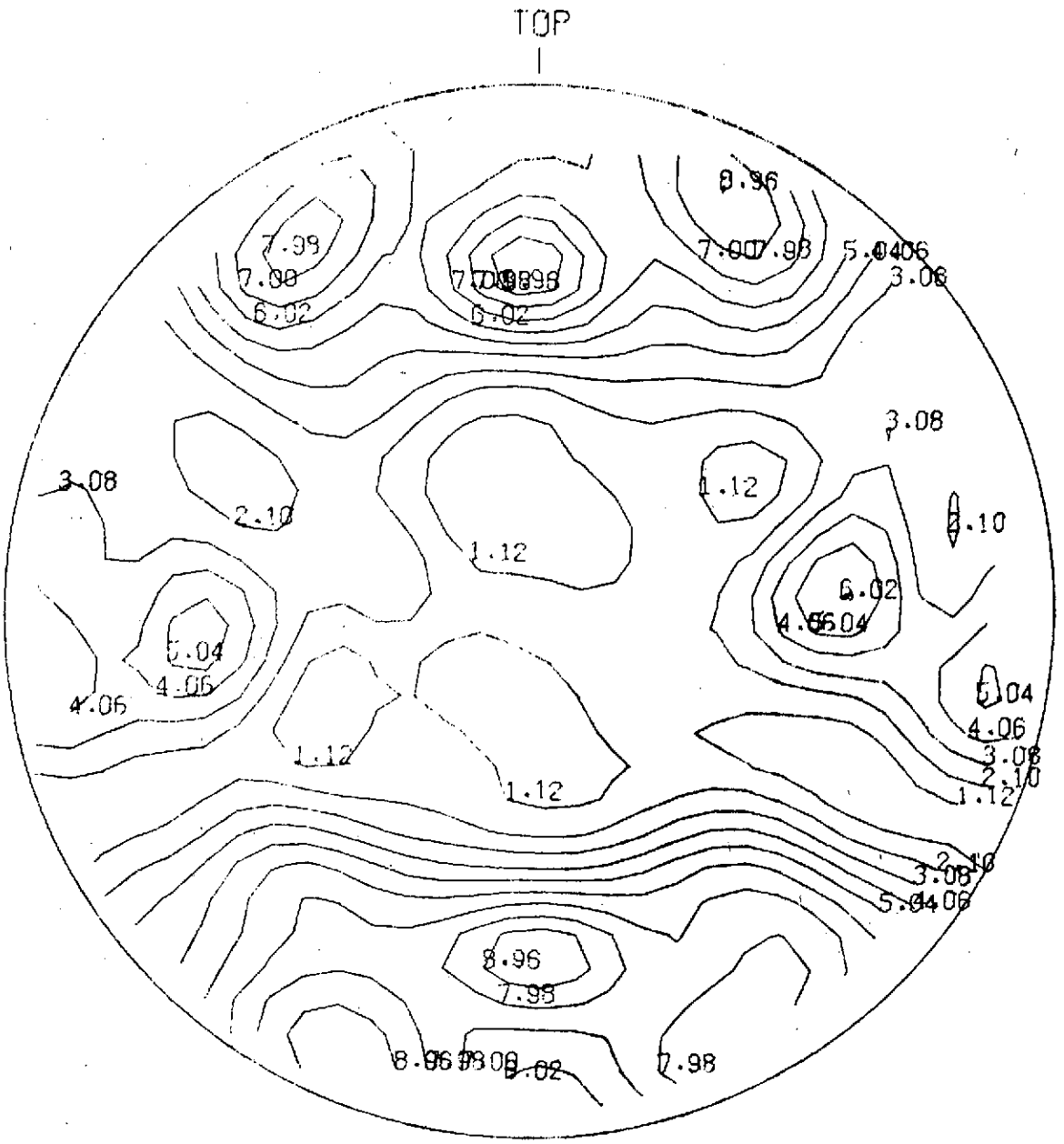


FIGURE B91

Encircled Energy

Vs

Field Angle

Task 2.4B2 - Off Nominal Cube

+ Mfg. Error + First Temperature

-On Axis

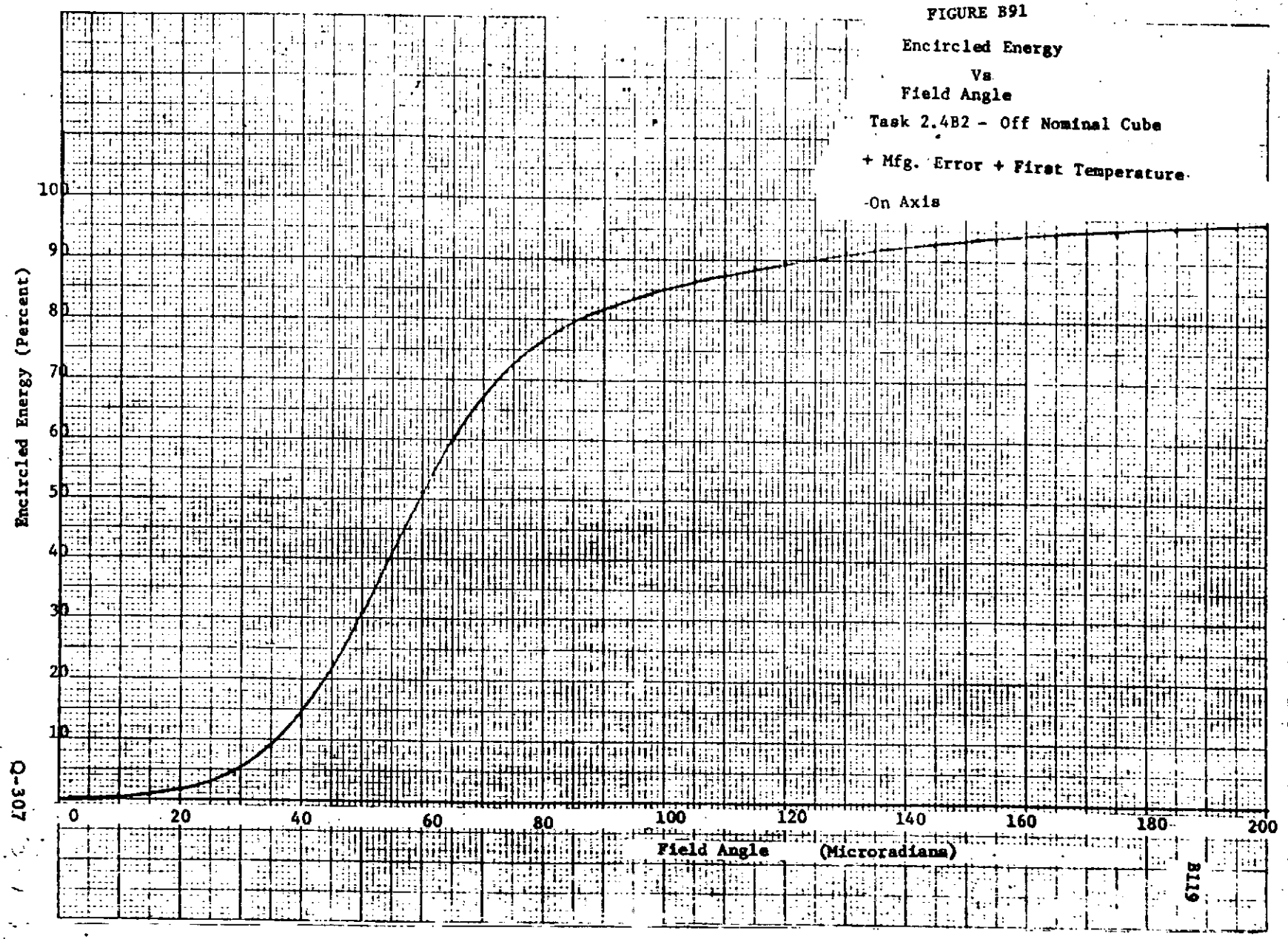


TABLE B28

ENCIRCLED ENERGY

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature -15° Off Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.00	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1
6.00	0.1	0.1	0.1	0.2	0.3	0.1	0.1	0.1	0.1
8.00	0.3	0.4	0.2	0.4	0.3	0.3	0.2	0.4	0.3
10.00	0.4	0.5	0.2	0.5	0.4	0.4	0.3	0.6	0.5
12.00	1.0	1.2	0.4	0.9	0.5	0.9	0.5	1.4	1.1
14.00	1.0	1.2	0.7	1.4	0.7	1.3	0.9	1.4	1.1
16.00	1.9	2.1	1.0	1.9	0.9	1.8	1.2	2.5	2.0
18.00	2.1	2.5	1.6	2.4	1.7	2.4	1.8	2.9	2.4
20.00	2.9	3.3	2.2	3.2	1.7	3.1	2.5	3.9	3.2
22.00	3.2	3.7	3.2	3.9	3.1	3.8	3.6	4.3	3.7
24.00	4.3	4.6	3.6	4.4	4.0	4.3	4.1	5.5	4.9
26.00	4.9	5.2	5.0	5.4	5.7	5.3	5.5	6.1	5.6
28.00	6.4	6.5	6.2	6.9	6.2	6.6	6.9	7.6	7.2
30.00	7.7	7.6	7.5	8.0	8.1	7.8	8.4	8.8	8.6
32.00	10.1	9.7	8.6	9.5	9.3	9.2	9.5	11.0	10.9
34.00	10.6	10.2	10.4	11.4	10.5	11.1	11.6	11.5	11.5
36.00	13.5	12.9	11.9	13.5	12.5	13.2	13.1	14.2	14.2
38.00	15.2	14.5	13.7	15.4	14.5	15.1	15.0	15.8	15.8
40.00	17.8	17.1	15.8	17.8	16.0	17.6	17.1	18.4	18.4
42.00	19.1	18.5	18.8	20.5	18.8	20.2	20.0	19.9	19.8
44.00	22.0	21.4	20.3	22.0	21.4	21.8	21.6	22.9	22.7
46.00	24.4	23.8	24.1	25.0	25.1	24.7	25.4	25.5	25.3
48.00	26.8	26.3	27.0	28.0	26.7	27.7	28.6	28.2	28.0
50.00	29.7	29.1	29.7	30.2	30.9	29.8	31.2	31.3	31.2
52.00	32.8	32.1	32.4	33.0	34.0	32.6	34.3	34.4	34.5
54.00	34.6	34.0	35.9	36.2	37.3	35.7	37.7	36.4	36.6
56.00	38.2	37.4	39.1	40.1	40.6	39.7	41.5	39.7	40.2
58.00	41.3	40.4	41.4	42.6	44.1	42.2	43.7	42.9	43.5
60.00	44.3	43.3	44.8	46.3	47.3	46.0	47.4	45.6	46.6
62.00	46.7	45.7	48.1	49.5	50.1	49.4	50.6	48.1	49.1
64.00	50.8	49.8	50.3	52.0	53.3	52.1	53.2	51.8	53.0
66.00	53.4	52.6	54.2	55.3	56.8	55.6	56.8	54.7	55.7
68.00	56.3	55.6	57.0	58.0	58.4	58.5	59.3	57.4	58.5
70.00	58.9	58.5	60.1	60.6	61.9	61.2	62.1	60.1	61.0
72.00	61.9	61.5	62.4	62.8	65.2	63.5	64.3	62.9	63.7
74.00	63.4	63.4	65.7	65.7	67.8	66.3	67.1	64.7	65.4
76.00	66.4	66.5	68.3	68.3	70.2	68.8	69.3	67.4	67.9
78.00	68.6	68.9	70.0	70.0	72.6	70.4	71.0	69.6	70.0
80.00	70.7	71.0	72.5	72.5	74.6	72.8	73.2	71.5	71.8

TABLE B29

ENCIRCLED ENERGY

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature -15° Off Axis

CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
5.00	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1
10.00	0.4	0.5	0.2	0.5	0.4	0.4	0.3	0.6	0.5
15.00	1.4	1.8	0.9	1.7	0.9	1.7	1.0	2.0	1.6
20.00	2.9	3.3	2.2	3.2	1.7	3.1	2.5	3.9	3.2
25.00	4.7	5.0	4.8	5.2	4.6	5.1	5.4	5.9	5.3
30.00	7.7	7.6	7.5	8.0	8.1	7.8	8.4	8.8	8.6
35.00	12.4	11.9	10.7	12.2	11.9	11.9	11.9	13.0	13.0
40.00	17.8	17.1	15.8	17.8	16.0	17.6	17.1	18.4	18.4
45.00	23.1	22.5	22.9	23.8	22.9	23.5	24.0	24.2	23.9
50.00	29.7	29.1	29.7	30.2	30.9	29.8	31.2	31.3	31.2
55.00	37.0	36.2	37.1	37.9	39.9	37.5	39.2	38.5	38.9
60.00	44.3	43.3	44.8	46.3	47.3	46.0	47.4	45.6	46.6
65.00	51.8	50.9	52.8	54.1	54.8	54.3	55.4	52.9	54.1
70.00	58.9	58.5	60.1	60.6	61.9	61.2	62.1	60.1	61.0
75.00	65.4	65.3	66.6	66.8	69.2	67.3	68.1	66.4	66.9
80.00	70.7	71.0	72.5	72.5	74.6	72.8	73.2	71.5	71.8
85.00	75.1	75.6	77.3	77.2	78.6	77.4	77.6	75.9	75.9
90.00	79.0	79.5	80.4	80.4	81.5	80.5	80.6	79.6	79.5
95.00	82.0	82.4	82.8	82.8	83.6	82.9	82.9	82.4	82.1
100.00	84.0	84.4	84.7	84.6	85.1	84.7	84.6	84.4	84.0
105.00	85.5	85.9	86.1	86.0	86.3	86.0	85.9	85.8	85.4
110.00	86.8	87.1	87.2	87.1	87.3	87.1	87.0	87.0	86.8
115.00	88.0	88.1	88.1	88.1	88.2	88.1	88.1	88.0	88.0
120.00	88.8	88.9	88.9	88.9	89.1	89.0	89.0	88.8	88.9
125.00	89.6	89.6	89.7	89.7	89.9	89.8	89.8	89.5	89.6
130.00	90.2	90.3	90.4	90.4	90.6	90.5	90.4	90.2	90.3
135.00	90.9	90.9	90.9	91.0	91.1	91.0	91.0	91.0	91.0
140.00	91.4	91.4	91.4	91.5	91.5	91.5	91.6	91.5	91.5
145.00	91.9	91.8	91.9	92.0	91.9	91.9	92.0	91.9	92.0
150.00	92.4	92.2	92.3	92.4	92.4	92.3	92.4	92.3	92.4
155.00	92.8	92.7	92.7	92.8	92.8	92.7	92.8	92.7	92.7
160.00	93.2	93.1	93.2	93.1	93.1	93.1	93.1	93.1	93.1
165.00	93.5	93.5	93.6	93.5	93.5	93.5	93.5	93.5	93.4
170.00	93.8	93.9	93.9	93.9	93.9	93.9	93.8	93.8	93.8
175.00	94.2	94.2	94.2	94.2	94.3	94.2	94.2	94.2	94.2
180.00	94.5	94.5	94.5	94.6	94.6	94.6	94.6	94.5	94.6
184.99	94.8	94.8	94.8	94.8	94.8	94.9	94.9	94.8	94.9
189.99	95.1	95.1	95.1	95.1	95.2	95.2	95.2	95.1	95.2
194.99	95.4	95.4	95.4	95.4	95.4	95.4	95.4	95.4	95.4
199.99	95.7	95.7	95.7	95.7	95.7	95.7	95.7	95.7	95.7

FIGURE B92

8122

Wavefront Map-(Polarization

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature -15° Off Axis

MAP IN UNITS OF 0.01 WAVES

```
                                                273 264 270 275
                                        315 303 290 278 267 259 264 270 275 281 287 293
                                    328 319 308 296 284 273 262 254 260 265 271 278 284 290 297 303
                                324 317 309 299 288 277 266 256 249 254 260 266 272 279 286 292 299 305
                            318 316 312 306 299 289 279 268 258 249 242 247 252 258 265 272 279 286 292 299 305 312
                        308 306 304 300 295 289 280 270 260 250 242 235 239 244 250 257 264 270 277 284 291 297 304 311
                        298 296 294 291 286 280 271 262 253 243 235 228 231 237 242 248 255 261 268 275 282 289 296 302
                    290 285 278 286 283 278 272 264 255 246 237 229 221 224 229 234 240 246 252 259 266 273 280 272 283 293
                300 293 286 279 271 263 271 265 257 249 241 232 223 215 217 222 227 232 237 244 250 258 251 263 273 284 293 303
                302 295 288 281 273 264 254 244 234 243 235 226 218 210 210 215 219 224 230 219 230 242 254 265 275 285 294 303
            310 303 297 290 282 273 264 253 243 232 222 212 220 212 204 203 207 212 202 212 223 234 246 257 268 278 287 296 304 311
            311 304 297 289 281 272 262 251 240 229 219 208 198 189 197 196 186 196 206 216 227 238 249 261 271 280 289 297 304 311
            311 304 296 288 280 270 259 248 236 225 214 204 194 203 199 200 208 200 210 220 230 241 252 263 273 282 290 297 304 311
                303 295 286 277 267 256 244 232 221 210 220 215 211 207 206 215 223 232 223 233 243 254 264 273 282 289 296 303
                303 294 284 274 264 252 241 229 239 233 228 223 218 213 212 220 229 238 246 254 244 254 263 272 280 287 294 301
                    293 283 273 262 268 261 254 248 241 235 230 225 220 218 226 234 243 252 260 268 274 275 270 278 285 291
                    293 282 291 284 277 270 263 256 250 243 238 232 227 224 232 240 249 258 267 275 282 286 290 292 282 289
                        306 295 292 286 279 272 265 259 252 246 240 235 231 238 246 256 266 275 283 290 295 298 300 302
                            308 301 294 288 281 274 267 261 254 248 243 238 245 254 264 274 284 293 300 305 309 311
                            308 302 296 289 282 275 269 262 256 250 245 252 262 272 283 294 303 311 317 321
                                307 301 295 288 282 275 269 262 257 251 259 269 280 292 303 314 322 329
                                    298 292 285 279 273 267 262 256 265 275 287 299 311 322
                                        288 282 277 272 266 261 269 280 293 305
```

FIGURE B93

Wavefront Plot-Q Polarization

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature -15° Off Axis

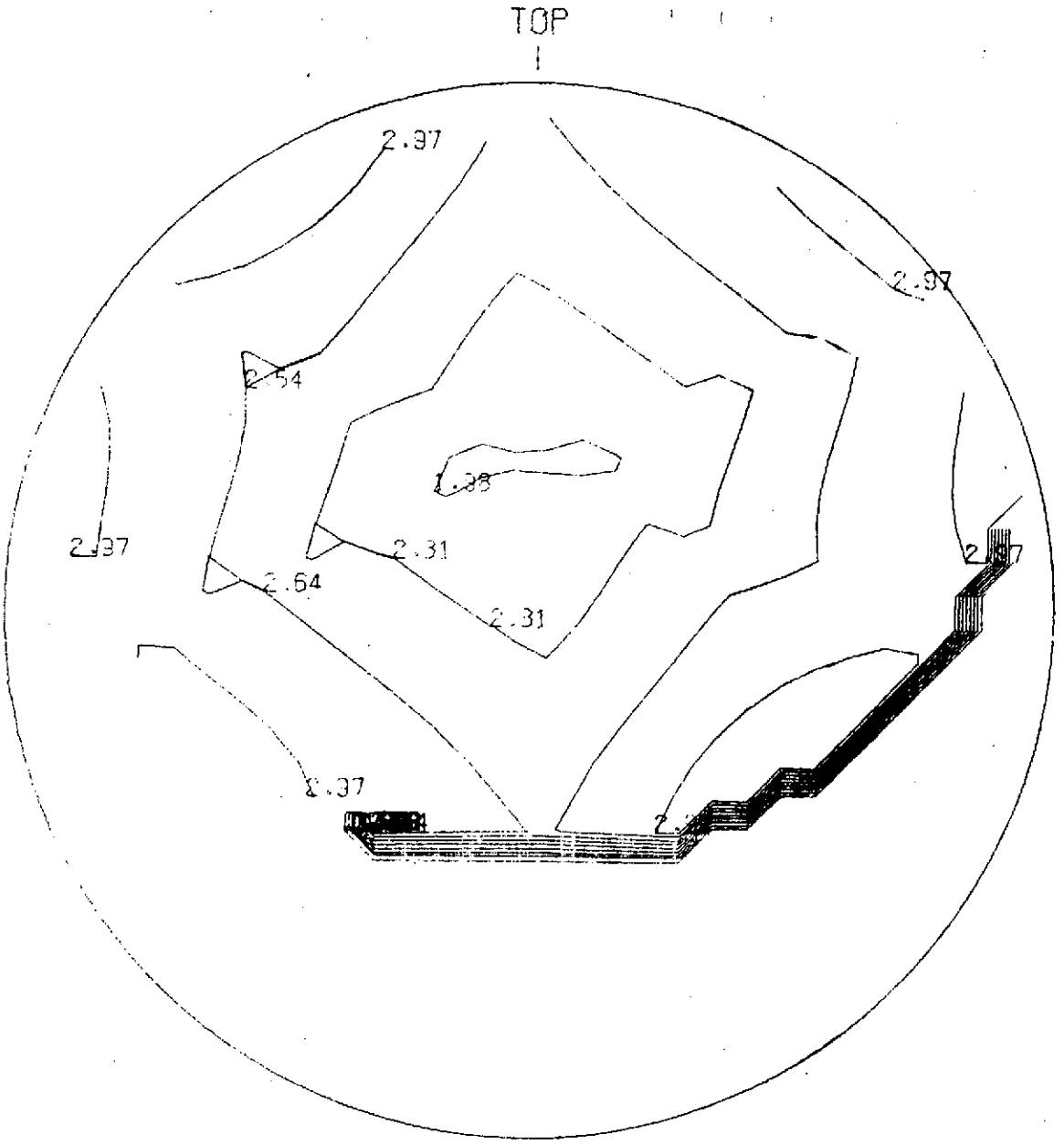


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FIGURE B94

Wavefront Map-P Polarization

B124

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature -15° Off Axis

MAP IN UNITS OF 0.01 WAVES

```
                                                243 234  89  94
                                        284 272 259 247 237 228  84  89  95 100 106 112
                                297 288 277 266 254 242 232 224  79  85  91  97 103 110 116 122
                            293 287 278 269 258 246 235 226 218  73  79  85  92  99 105 112 118 125
                        288 285 281 275 268 259 249 238 227 218 211  66  72  78  85  91  98 105 112 118 125 131
                    277 276 273 270 265 258 249 240 229 220 211 204  59  64  70  76  83  90  97 103 110 117 123 130
                    267 266 263 260 256 249 241 232 222 213 204 197  51  56  62  68  74  81  88  94 101 108 115 122
                306 299 293 256 252 248 241 233 225 216 207 158 191  43  48  54  59  65  72  78  86  93 100 139 150 160
            316 309 302 295 288 279 241 234 227 219 210 201 193 185  36  41  46  51  57  63  70  77 118 130 140 151 160 170
            318 311 305 297 289 280 270 260 250 213 204 196 187 179  30  34  39  44  49  86  97 109 121 132 142 152 161 170
        327 320 313 306 298 290 280 270 259 248 238 228 190 181 173  23  27  31  69  79  89 101 113 124 135 145 154 163 171 178
        327 320 313 306 298 289 279 268 256 245 235 225 215 205 166  15  53  63  73  83  94 105 116 128 138 147 156 164 171 178
        328 320 313 305 296 286 276 264 252 241 231 220 210  32  28 179 187  67  77  87  97 108 119 130 140 149 157 164 171 178
            320 312 303 293 283 272 260 249 237 226  49  44  39  35 185 193 202 210  90 100 110 121 131 140 149 156 163 170
            319 310 301 291 280 269 257 245  68  62  56  51  46  42 191 199 208 216 225 233 111 121 130 139 147 154 161 168
                309 299 289 278  97  90  83  76  70  64  59  54  49 197 204 213 222 231 239 247 253 258 137 145 152 158
                309 299 120 113 106  99  92  85  78  72  67  61  56 203 210 219 228 237 246 254 260 265 268 271 149 156
                135 128 121 114 108 101  94  87  81  75  69  64 210 217 225 234 244 254 262 269 274 277 279 281
                    136 130 123 117 110 103  96  89  83  77  71 217 224 232 242 253 263 272 279 284 288 290
                    137 131 124 118 111 104  97  91  84  79 224 231 240 251 262 273 282 290 296 300
                    136 130 123 117 110 104  97  91  85 230 238 248 259 271 282 292 301 307
                        126 120 114 108 102  96  90 235 243 254 266 278 290 301
                        117 111 106 100  95 239 248 259 271 284
```

ADD
1
NONE

FULL AVERAGE AVERAGE QUARTER PLOT NUMBER 4
TEMPERAT

RMS 0.85 PK-PK 3.12 FRED WAVEFRONT

B125

FIGURE B95

Wavefront Plot-P Polarization

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature -15° Off Axis

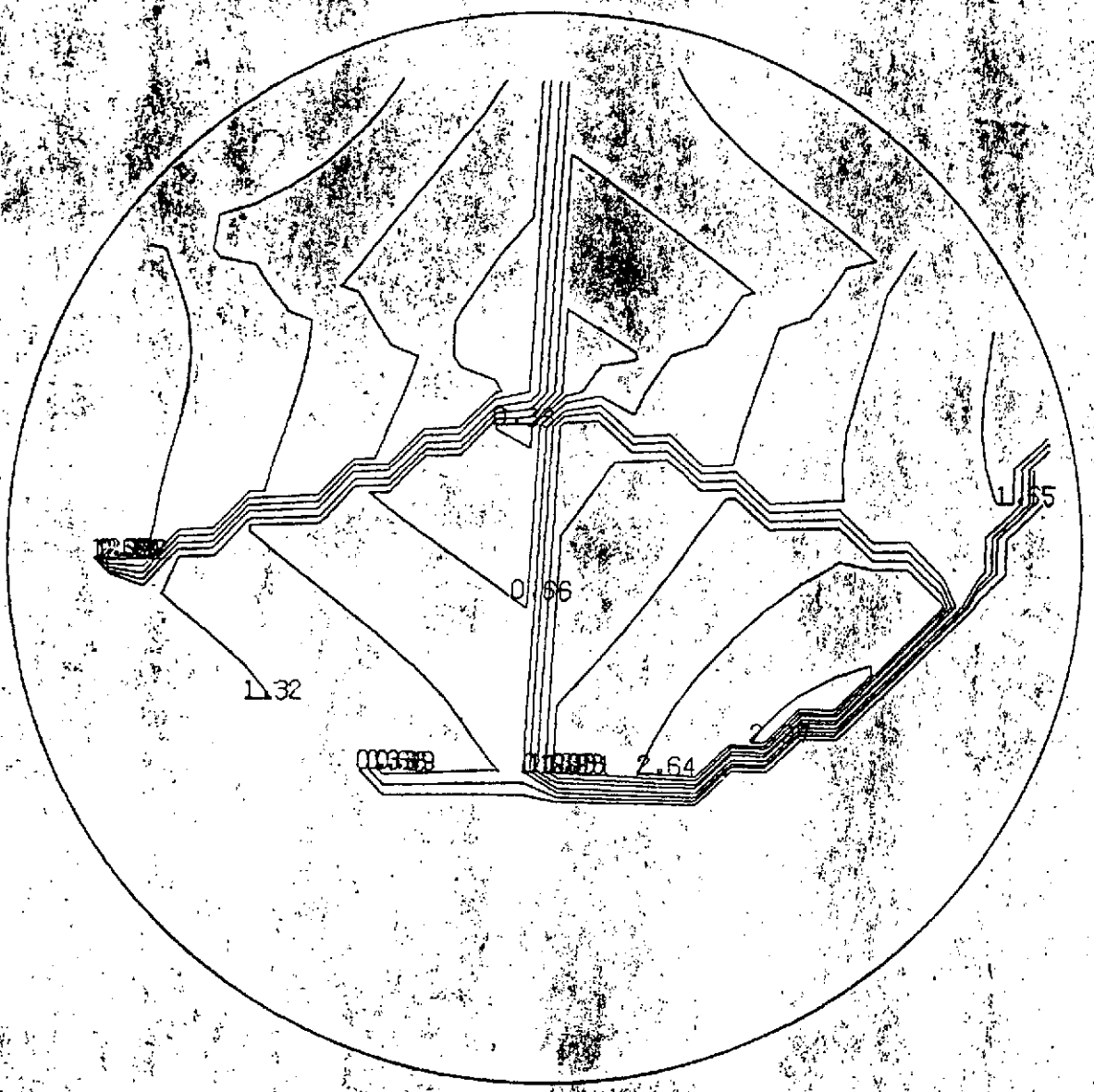

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FIGURE B96

Task 2.482 - Off Nominal Cube + Mfg. Error + First Temperature -15° Off Axis

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.04 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0146 = 100
TOTAL ENERGY = 0.18704000+01
MAP REPRESENTS 0.1738195D+01 OR 92.9318 PERCENT OF TOTAL ENERGY

B126

```
  0  1  1  1  1  1  1  1  0  0  0  0  0  0  0  1  1  1  2  2  0  0  0  0  0  0  1  1  1  1  1  0  0  1  1
  0  1  1  1  1  2  1  0  1  1  1  0  0  0  0  1  1  1  2  2  1  1  1  0  0  1  1  0  1  1  1  1  0  1  1
  0  0  0  1  1  1  1  1  2  2  1  1  0  0  1  2  1  1  3  4  2  1  0  0  0  1  1  0  1  1  1  1  0  0  0
  0  0  0  0  0  1  1  2  2  1  2  1  0  0  2  4  3  2  4  5  2  1  0  1  1  1  1  1  1  1  0  1  1  0  0
  0  0  0  1  1  1  2  2  2  2  2  1  1  1  2  4  4  3  5  4  1  2  1  0  1  2  1  2  1  1  0  1  1  0  0
  0  0  1  1  2  2  2  3  3  3  2  1  2  2  2  3  3  3  6  4  1  3  3  1  1  2  2  2  1  1  1  1  1  0  0
  0  0  1  2  3  3  3  4  4  3  2  3  5  3  2  4  3  3  6  6  3  2  4  3  2  2  2  3  1  1  2  1  1  1  1
  0  1  1  1  2  3  3  3  3  3  5  9  9  5  7  8  4  4  6  9  8  5  6  6  4  3  2  2  2  1  1  0  0  1  1
  0  1  1  1  1  1  2  2  3  6 11 16 15 13 15 10  5  6  6 10 15 16 17 13  7  5  2  1  2  1  1  1  1  0  0
  1  1  1  2  2  1  2  4  6 10 17 22 22 22 19  8  5  9  9 13 21 28 31 23 12  7  4  1  2  1  1  1  1  1  1
  2  1  1  2  2  2  6  9  9 15 27 31 30 29 19  8  7 11 16 23 27 30 33 30 17  6  2  1  2  2  1  1  1  1  1
  2  2  1  2  3  6 11 15 17 29 44 43 44 42 25 13  8  8 19 30 35 37 33 32 25 10  3  3  4  4  4  3  2  2  2
  2  2  2  3  5  9 13 19 28 46 56 51 62 63 38 21 11  6 14 24 40 56 49 38 35 21 10  8  5  6  6  5  3  2  2
  1  1  2  4  6  7  9 17 31 47 49 53 76 70 41 26 14 11 16 20 37 68 68 45 37 28 16  9  4  3  4  4  2  1  1
  1  1  1  3  4  3  4 12 24 35 38 56 77 55 34 25  9 10 21 32 39 57 68 48 31 24 14  6  1  1  2  2  1  0  1
  1  1  1  2  3  3  5 10 18 28 37 58 61 34 34 27  3  4 14 40 46 39 56 52 32 23 14  5  1  1  1  1  1  1  1
  1  1  0  1  2  3  5  7 13 23 30 40 32 18 39 29  6 11  3 32 48 26 38 45 32 26 17  7  2  1  1  1  1  0  1
  0  0  1  1  1  1  3  6 10 15 14 16 13 16 42 25  9 21  4 24 41 15 17 22 19 23 18 10  3  0  0  1  1  1  0
  0  1  1  1  0  0  3  7  8  8  8 17 31 37 50 31  9 12  7 28 36 19 20 11  6 14 16 14  9  3  1  1  2  2  1
  0  1  1  1  1  1  4  6  4  5 14 40 70 69 61 47 18  2 11 36 42 50 58 30  8  6  9 14 12  5  1  1  2  2  1
  0  1  1  1  0  1  2  3  2 10 29 60 94 85 55 42 25  8 17 35 50 84 94 55 24  8  2  7  8  5  2  1  1  1  1
  0  1  1  1  1  1  1  4 10 26 51 74 95 82 41 20 16 14 17 25 49 91100 75 55 29  8  3  3  4  4  3  2  1  1
  1  1  2  2  2  2  3  7 16 35 63 77 79 68 41 19 10  9 10 17 41 73 89 94 88 53 22  9  4  3  3  3  2  1  1
  1  1  1  1  1  2  3  6 12 23 46 58 52 44 42 35 20  8  7 17 32 51 72 91 84 52 28 17  7  2  1  1  1  1  0
  1  1  1  1  1  1  2  3  4  7 17 29 31 26 30 34 26 12  9 17 24 32 48 57 46 30 23 17  8  3  1  1  0  1  0
  0  1  0  1  1  2  2  1  1  2  5 14 26 25 18 18 18 12  8 12 16 20 25 22 15 12 12  9  5  2  2  1  0  0  0
  0  0  0  0  2  2  2  1  1  3  5 10 21 23 15  9 10  8  5  7 11 13 12  8  5  4  2  1  1  1  1  0  0  0  0
  0  0  0  0  1  2  3  4  3  3  6  7  9 12 12  9  6  4  4  7  8  8  6  5  3  1  1  1  1  0  1  0  0  0  0
  0  0  0  0  1  2  2  5  5  4  3  4  2  3  7  8  5  2  4  7  5  3  3  2  2  4  6  5  2  1  1  0  0  0  0
  0  0  0  0  1  1  1  2  4  3  1  1  1  0  2  6  6  3  3  4  2  1  1  1  3  6  7  5  3  3  2  0  0  0  0
  1  0  0  1  1  0  0  0  1  1  0  0  1  0  1  4  5  4  3  3  1  0  0  1  3  4  4  3  3  3  2  0  0  0  0
  0  0  0  1  1  0  0  0  0  0  1  0  0  1  2  3  3  2  2  3  1  0  0  1  2  2  1  1  1  1  1  0  0  0  0
  0  0  0  1  2  1  1  1  1  0  1  0  0  1  3  3  2  1  1  2  1  0  0  1  1  1  1  1  0  0  0  1  0  0  0
  0  0  0  1  2  2  2  1  0  0  0  0  1  1  2  2  2  1  1  1  1  1  0  0  0  1  1  0  1  2  2  1  1  0  0  0
  0  0  0  0  1  1  2  1  0  0  0  1  2  1  0  1  1  1  1  1  0  1  0  0  0  0  0  0  2  3  2  1  1  1  0  0
 10
 10
```

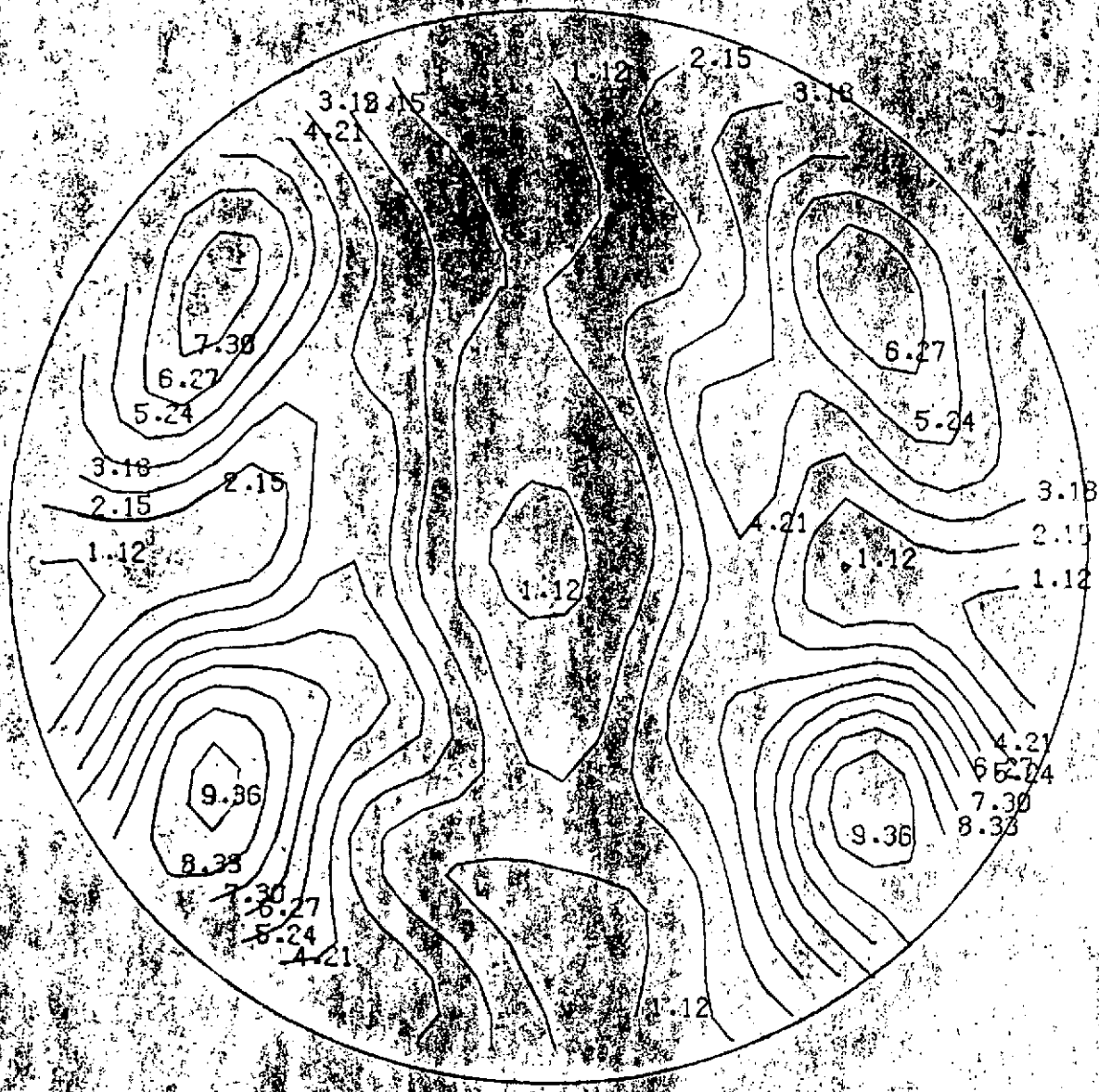
IO
IO
NONE RMS 12.28 PK-PK 10.25 FREQ 1 WAVEFRONT

B127

FIGURE B97

Intensity Distriubtion - Central 129 Microradians

Task 2.4B2 - Off Nominal Cube + Mfg. Error + First Temperature -15° Off Axis



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K-E 10 X 10 TO ½ INCH KEUFFEL & ESSER CO. MADE IN U.S.A.

FIGURE B98

Encircled Energy
Vs
Field Angle

Task 2.4B2 - Off Nominal Cube
+ Mfg. Error + First Temperature
-15° Off Axis

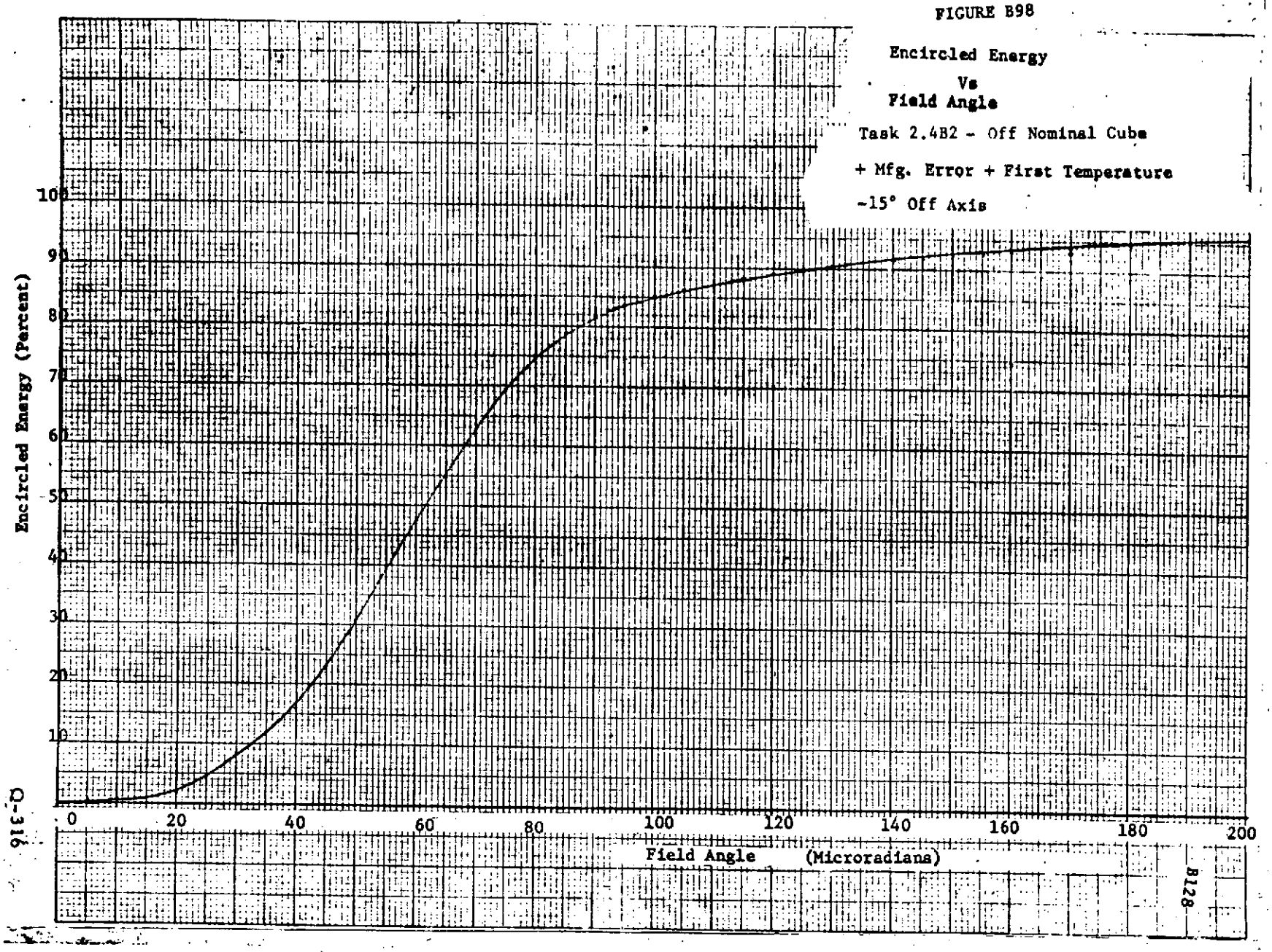


TABLE B30

ENCIRCLED ENERGY IN THE

32-42 MICRORADIAN RING

FOR 2.1 $\widehat{\text{SEC}}$ DIHEDRAL ANGLE VARIATION

Task	Case	Percent Energy 32-42 Microradians	
		On Axis	Full
2.1	Nominal Cube	14.9	7.3
2.2	Nominal Cube + $\lambda/4$	13.3	6.9
2.3B	Nominal Cube $+\lambda/4$ + Temp 1	12.3	6.2
2.3A1	Nominal Cube $+\lambda/4$ + Temp 2	14.4	
2.3A2	Nominal Cube $+\lambda/4$ + Temp 3	13.8	
2.4A	Off Nominal Cube $+\lambda/4$	13.6	6.9
2.4B2	Off Nominal Cube $+\lambda/4$ + Temp 1	12.5	6.2
2.5A	Nominal Cube $+\lambda/4$ + Axial Grad.	19.8	
2.5B	Nominal Cube $+\lambda/4$ + Radial Grad.	1.2	

APPENDIX C

Viewgraph Presentation

The following pages C2-C20 are copies of the viewgraphs presented at a briefing at George C. Marshall Space Flight Center, Huntsville, Alabama on 4 September, 1974.

Itek

THERMO-OPTICAL ANALYSIS

LAGEOS

PREPARED UNDER

CONTRACT TO

BENDIX AEROSPACE SYSTEMS DIVISION

4 SEPTEMBER 1974

TOPICS

- PURPOSE/OBJECTIVES
- SUMMARY OF RESULTS
- ASSUMPTIONS/INPUTS
- TECHNIQUES/MODEL
- OUTPUT
- CONCLUSIONS/FUTURE EFFORT

PURPOSE/OBJECTIVES

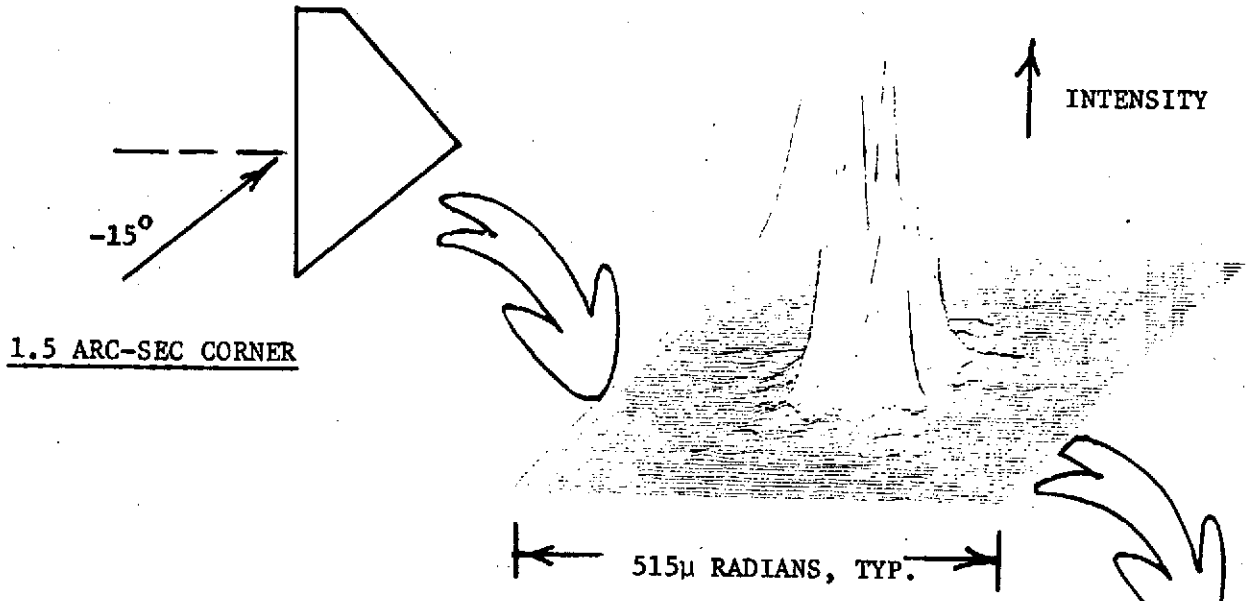
ANALYTICALLY PREDICT LAGEOS OPTICAL PERFORMANCE/SENSITIVITY

- MODEL INDIVIDUAL RETROREFLECTOR
  - MATERIAL
  - MANUFACTURING
    - SURFACE QUALITY
    - ANGULAR ANOMALIES
  - ENVIRONMENTAL LOADING

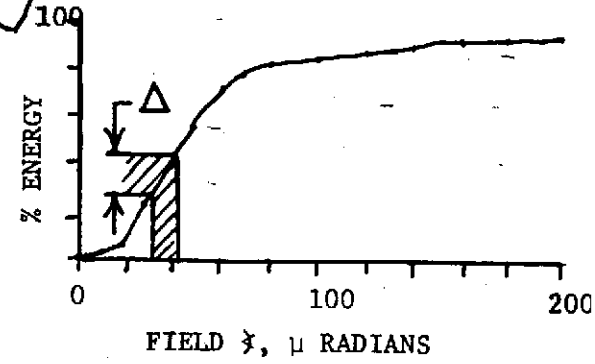
PURPOSE/OBJECTIVES CONTINUED

- FAR FIELD CHARACTERISTICS
  - FIELD ANGLE
  - POLARIZATION EFFECTS
  - ENCIRCLED ENERGY
  - FAR FIELD PATTERN

FAR-FIELD CHARACTERISTICS



FAR FIELD DIFFRACTION PATTERN



ENCIRCLED ENERGY

SUMMARY - NOMINAL CUBE CORNERS

% ENCIRCLED ENERGY, 32 TO 42μ RADIAN REGION, TYP.

(ASSUMES 100% INPUT @ 0°)

	0°	-15°
1.5 ARC-SEC	21.6	10.8
2.1 ARC-SEC	14.9	7.3

SUMMARY OF SENSITIVITY RESULTS - MANUFACTURING

(CHANGES IN ENCIRCLED ENERGY SHOWN ARE ACTUALS, NOT %' S OF %' S)

- SURFACE QUALITY
  - UP TO 1.6% CHANGES
  - $\sim\lambda/4$ PK-PK SMOOTH WFE/SECTOR
- ANGULAR DIFFERENTIALS
  - UP TO 0.4% CHANGES
  - CORNER WITH ± 0.5 ARC-SEC ANGLES
- CONSTANT ϟ ERROR
  - UP TO 8.1% CHANGES
  - 2.1 vs 1.5 ARC-SEC CORNERS

SUMMARY OF SENSITIVITY RESULTS - 3D TEMPERATURE MAPS

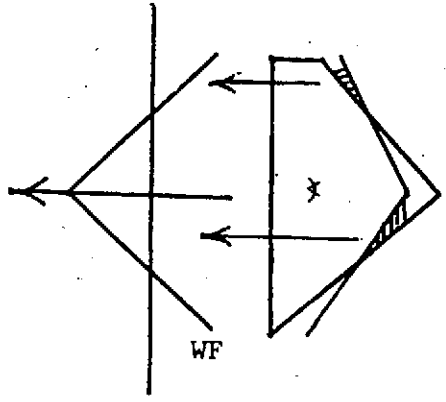
(FACE COOL, EDGE WARM)

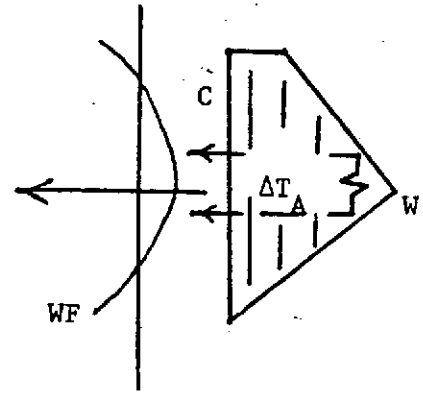
- +30°C CAVITY, W/SUN, W/O IR
  - UP TO 1.1% CHANGES
  - 1.9°C ΔT_A, 1.3°C ΔT_R
- -30°C CAVITY, W/SUN, W/O IR
  - UP TO 1.1% CHANGES
  - 1.0°C ΔT_A, 0.4°C ΔT_R
- ESTIMATED MAXIMUM
  - UP TO 1.0% CHANGES
  - 3.5°C ΔT_A, 2.0°C ΔT_R

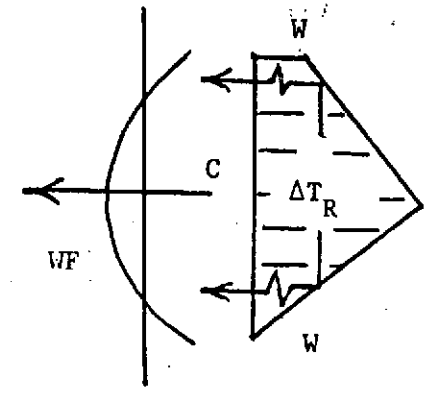
SUMMARY OF SENSITIVITY RESULTS - UNIT LOADS

$$dw = \int_{\text{NOMINAL RAY PATH}} dn(S)\, ds$$

- 1.5°C AXIAL GRADIENT
  - 1ST REMOVES ⚹ ERROR, THEN ADDS
  - 21.2 → ~10% (ENERGY TO CORE) → 18.0%
- 2.0°C RADIAL GRADIENT
  - UP TO 16.1% LOSSES

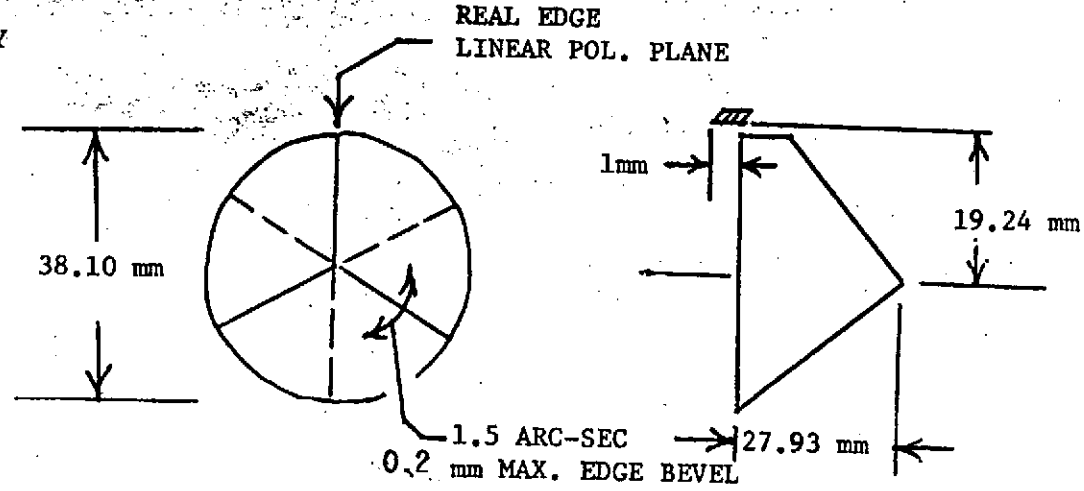






ASSUMPTIONS/INPUTS

- MATERIAL
  - T-19 SUPRASIL 1 (SPECIAL)
  - AMERSIL DATA - $N(\lambda)$, $\partial n/\partial T$ (λ,T,P) → 7 to 8.5 x
  - HOMOSIL, CONSERVATIVE
- GEOMETRY

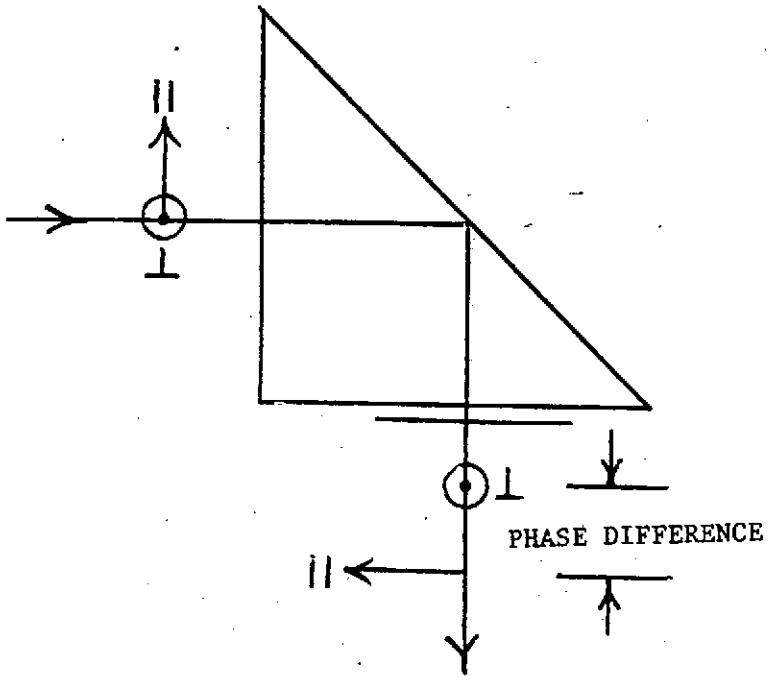


- LASER
  - 6328Å, FLAT WF, CENTERED
  - 20% GAUSSIAN VARIATION OVER 50 mm DIAMETER

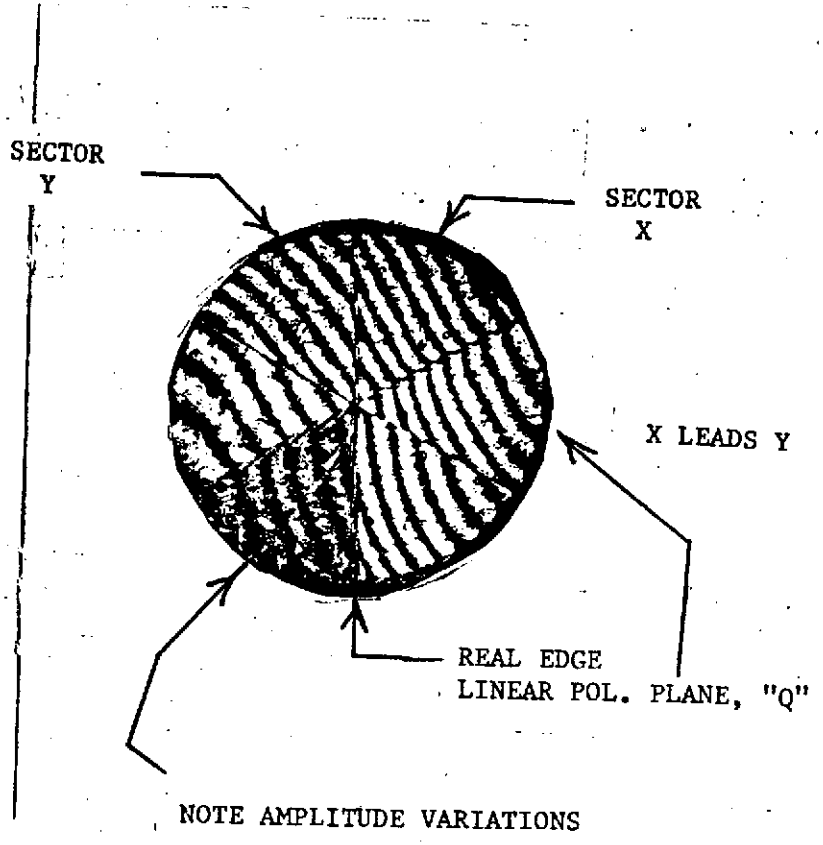
TOTAL INTERNAL REFLECTION

LIGHT REFLECTS AND POLARIZATION STATE IS CHANGED

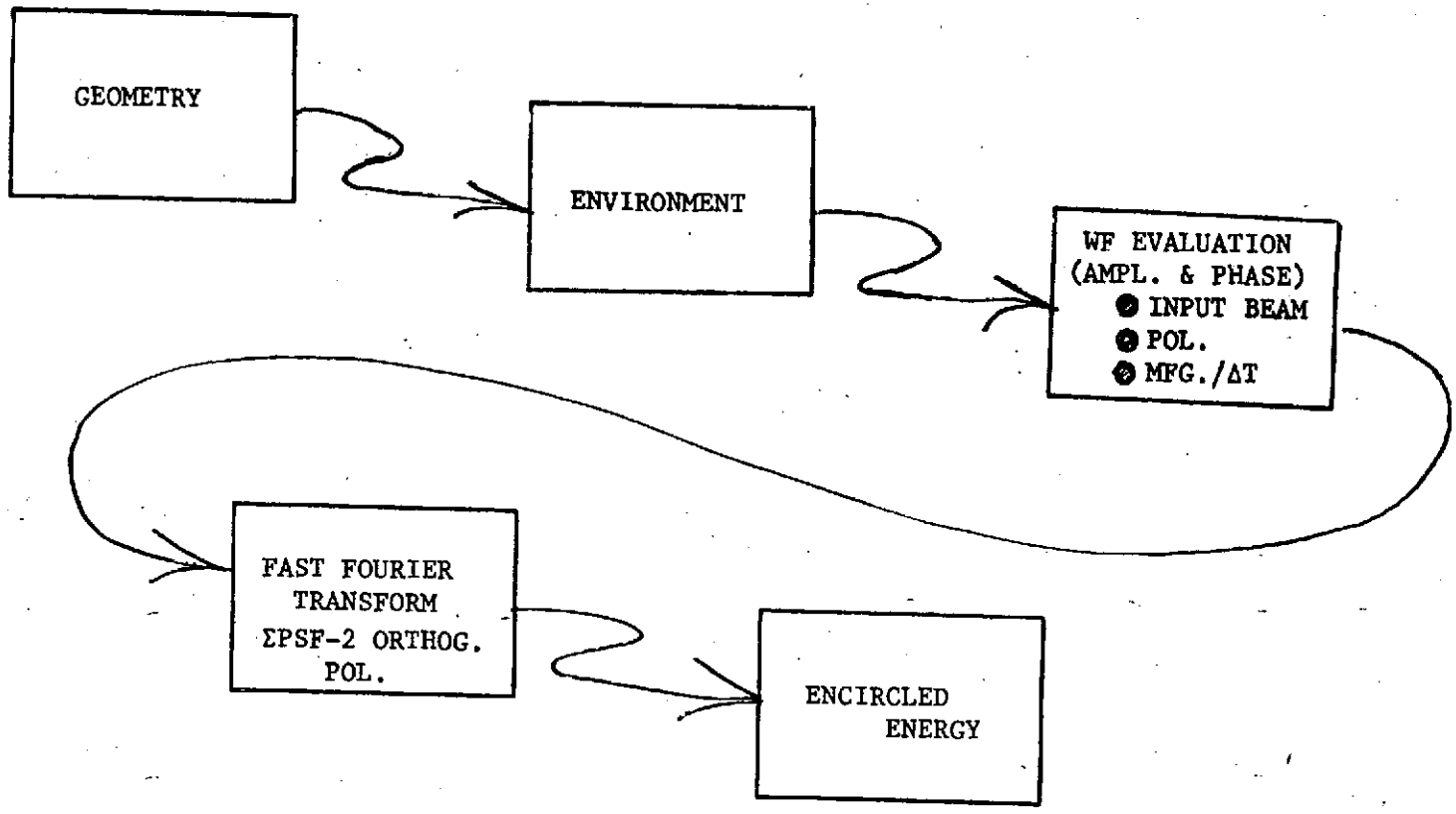
2-D, CARTOON



3-D, INTERFEROGRAM



TECHNIQUES/MODEL



ACCURACY ~ 1% IN ENCIRCLED ENERGY

OTHER TYPES OF OUTPUT

"P/Q" AMPLITUDES & PHASES
(NOMINAL CUBE, -15°)

"P" WAVEFRONT

PSF-CENTRAL 129μ RADIANS

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OUTPUT CONTINUED

TABLE 24

Task 2.1 - Nominal Cube -15° Off Axis

PRINTER MAP OF POINT SPREAD FUNCTION

(ONE SPACE REPRESENTS 8.06 MICRONS)
NORMALIZED SO LARGEST VALUE = 0.0215 = 100
TOTAL ENERGY = 0.1970400E+01
MAP REPRESENTS 0.1742041E+01 OR 93.1373 PERCENT OF TOTAL ENERGY

```
0 0 0 1 1 1 0 0 0 0 1 3 0 0 0 0 3 0 0 0 0 3 0 0 1 0 0 0 3 1 1 1 0 0 0
0 0 0 0 1 1 0 0 1 1 0 0 0 1 1 1 1 0 0 0 1 1 1 1 0 3 0 0 1 0 0 1 1 0 0 0
0 0 0 0 0 0 0 1 0 0 1 1 1 1 1 1 0 1 1 1 1 1 1 1 0 0 0 1 1 1 0 0 0 0 0 0
0 0 0 0 0 0 0 0 1 1 1 0 1 2 1 1 0 0 2 2 2 2 2 2 0 0 1 1 2 1 0 1 1 0 0 0 0 0 0
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 3 1 2 2 2 2 1 0 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0
0 0 0 0 0 0 1 1 1 1 1 1 1 2 2 1 1 2 2 1 2 2 1 1 1 1 1 1 1 1 1 1 0 1 1 1
0 0 0 0 0 1 1 1 1 1 1 1 2 3 6 3 7 4 4 4 7 9 6 3 2 1 1 1 1 1 1 0 0 0 0 0 0
0 0 0 0 1 1 0 1 1 1 1 1 4 8 11 11 9 9 8 9 9 11 11 8 4 1 1 1 1 0 1 1 1 0 0 1 1
0 0 0 1 1 1 1 1 1 1 2 5 9 13 16 19 15 10 15 19 16 13 9 5 2 1 1 1 1 1 1 1 0 0 1 1
0 0 1 1 2 2 2 3 4 5 5 12 23 30 33 22 11 22 33 30 23 12 5 5 4 3 2 2 2 1 1 1 1 1
0 0 1 2 2 2 3 4 7 9 12 26 36 39 43 34 24 34 43 39 26 26 12 9 7 4 4 3 2 2 2 2 1
0 1 1 2 2 3 3 4 7 13 23 36 35 38 47 45 41 45 48 38 35 36 22 12 7 4 3 3 2 2 1 2 2 1
0 1 2 2 3 2 1 4 14 29 34 30 47 56 42 37 42 56 47 30 34 28 14 6 1 2 3 2 2 1 0 1 1 1
0 1 2 3 2 1 5 15 29 30 34 66 53 32 33 32 57 65 34 30 29 15 5 1 2 3 2 1 0 1 1 1
0 1 2 3 2 1 5 13 23 22 30 55 34 33 62 33 34 55 30 21 23 13 5 1 2 3 2 1 0 0 1 0
0 1 2 1 1 0 1 5 9 12 9 12 27 11 39 86 39 11 26 12 9 12 8 5 1 0 1 1 1 0 0 0 1
0 1 2 1 0 1 1 4 5 5 4 10 33 34 41 41 41 34 34 10 4 5 5 6 3 1 0 1 2 1 1 0 0 1
0 1 2 2 1 2 4 4 3 6 15 28 62 86 54 33 54 86 68 29 15 6 3 5 4 2 1 1 2 1 1 1 1
0 1 1 2 2 2 3 3 7 12 33 47 76 100 69 39 69 100 76 47 33 12 3 3 2 2 1 1 1 1 0 1 1
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0 1 1 2 2 2 1 4 12 25 48 65 56 41 31 26 30 41 56 65 49 25 13 4 1 2 2 2 1 1 1 1 1
0 0 1 1 1 1 1 4 12 19 32 43 46 35 29 13 23 35 46 43 28 18 12 4 1 1 1 1 1 1 0 0 0
0 0 1 1 1 1 1 2 6 9 9 14 23 26 19 12 16 26 23 14 9 8 6 2 1 1 1 1 0 0 0 1 0 0
0 0 1 1 1 0 1 1 2 4 4 6 11 11 9 11 11 6 4 4 2 1 1 0 1 1 1 0 0 0 1 1 0 0
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0 0 0 0 0 0 0 0 1 1 1 1 1 0 0 0 1 1 1 1 1 1 0 0 0 1 1 1 1 1 1 1 0 0 0 0
0 0 0 0 0 0 0 0 0 1 1 1 1 1 3 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0
```

TABLE 5

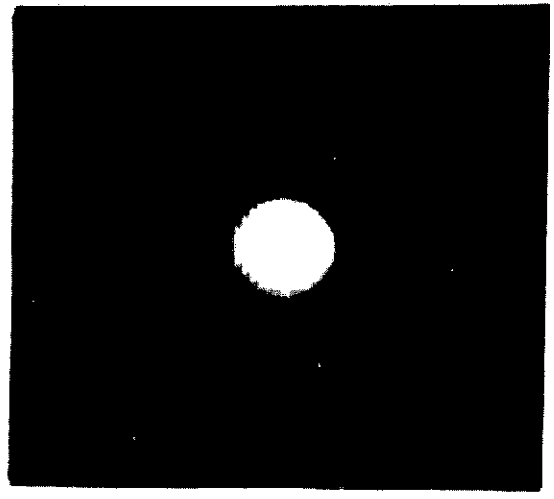
Task 2.1 - Nominal Cube -15° Off Axis

ENCIRCLED ENERGY

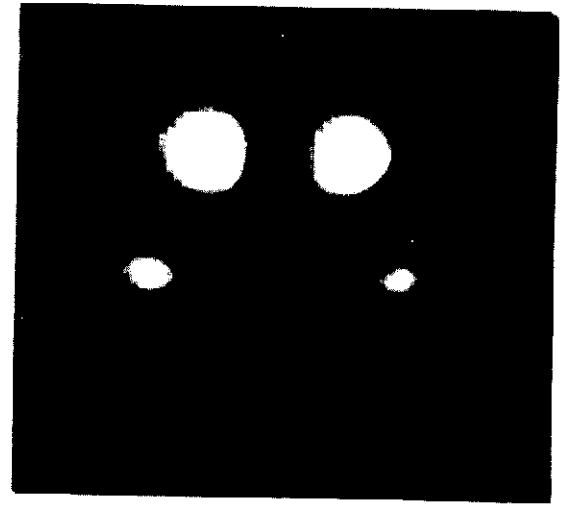
CIRCLE RADIUS (MICRONS)	PERCENT ENERGY WITHIN CIRCLE CENTERED AT INDICATED COORDINATES								
CENTER (MICRONS): X=	-10.13	10.13	0.0	-10.13	0.0	10.13	0.0	-10.13	10.13
Y=	-10.13	-10.13	-10.13	0.0	0.0	0.0	10.13	10.13	10.13
2.00	0.0	0.0	0.1	0.0	0.2	0.0	0.1	0.0	0.0
4.00	0.4	0.4	0.3	0.2	0.2	0.2	0.3	0.5	0.5
6.00	0.4	0.4	0.9	0.5	1.8	0.5	1.0	0.5	0.5
8.00	1.2	1.2	1.7	1.2	1.8	1.2	1.8	1.6	1.6
10.00	1.7	1.7	2.1	1.6	3.4	1.6	2.4	2.2	2.2
12.00	3.9	3.9	3.4	3.0	3.9	3.0	3.8	4.6	4.6
14.00	3.9	3.9	4.5	4.6	4.9	4.6	5.4	4.6	4.6
16.00	6.6	6.5	5.8	6.1	5.7	6.0	7.0	7.7	7.7
18.00	7.6	7.6	7.2	7.8	8.0	7.8	8.8	9.0	9.0
20.00	9.9	9.8	9.4	9.9	8.0	9.9	11.5	11.5	11.6
22.00	11.0	11.0	11.5	12.3	11.4	12.3	14.0	12.9	12.9
24.00	13.7	13.7	13.2	13.6	13.7	13.5	15.9	16.0	16.0
26.00	15.0	15.0	16.0	16.5	17.9	16.5	18.9	17.6	17.6
28.00	19.1	18.0	19.2	19.3	19.3	19.3	22.6	20.8	20.8
30.00	20.2	20.2	21.9	22.3	24.1	22.3	25.0	23.6	23.6
32.00	24.6	24.6	24.5	24.7	27.0	24.7	27.7	27.7	27.7
34.00	25.4	25.4	27.7	28.7	30.2	28.7	30.9	28.7	28.7
36.00	30.4	30.4	30.9	31.8	34.2	31.8	34.1	33.2	33.1
38.00	32.8	32.8	34.2	35.4	37.8	35.4	36.7	35.7	35.7
40.00	36.9	36.9	37.6	38.9	39.9	38.9	40.3	39.4	39.4
42.00	39.1	39.1	41.5	43.1	43.6	43.0	43.8	41.5	41.5
44.00	43.5	43.5	44.1	45.0	46.4	45.0	46.3	45.6	45.6
46.00	46.3	46.3	47.8	49.3	50.3	49.3	50.0	48.6	48.6
48.00	49.7	49.7	51.4	52.4	52.0	52.4	53.9	51.9	51.8
50.00	52.7	52.7	53.8	55.0	56.2	55.0	56.2	55.1	55.1
52.00	55.7	55.7	56.8	57.8	59.3	57.8	59.4	58.3	58.3
54.00	57.6	57.6	59.6	60.9	62.7	60.8	62.1	60.1	60.1
56.00	60.8	60.8	62.9	64.0	65.7	63.9	65.4	63.2	63.2
58.00	63.3	63.3	64.9	66.0	68.9	66.0	67.2	65.7	65.7
60.00	65.6	65.6	67.6	69.9	71.3	68.9	69.9	67.9	67.9
62.00	67.6	67.6	69.9	71.3	73.4	71.3	71.9	69.7	69.7
64.00	70.7	70.7	71.7	73.0	75.2	73.0	73.5	72.1	72.1
66.00	72.6	72.6	74.1	75.3	77.0	75.3	75.5	73.8	73.8
68.00	74.6	74.7	76.0	76.7	77.7	76.7	76.8	75.5	75.5
70.00	76.2	76.2	77.6	78.1	79.1	78.1	78.1	76.8	76.8
72.00	78.0	78.0	78.9	79.1	80.2	79.1	79.1	78.2	78.2
74.00	79.9	78.9	80.2	80.3	81.1	80.3	80.1	79.0	79.0
76.00	80.4	80.4	81.3	81.2	81.8	81.2	81.0	80.2	80.2
78.00	81.3	81.3	81.8	81.9	82.6	81.9	81.5	81.0	81.0
80.00	82.2	82.2	82.7	82.7	83.2	82.7	82.3	81.8	81.8

ITEK LASER SCANNER RECORDER PHOTOGRAPHS

(PERFECT BK7 CORNER)
(NOTE-UNCALIB. EXAMPLE)



"Q" - 61 % OF TOTAL ENERGY



"P" 39 % OF TOTAL ENERGY

CONCLUSIONS

- ALL ENCIRCLED ENERGY DATA AVAILABLE FOR TEST CORRELATION.
- RETROREFLECTOR RELATIVELY INSENSITIVE - $\lambda/4$, $\pm$0.5 ARC-SEC.
- SENSITIVITY TO CONSTANT γ ERROR - $\leq$ 6.8% CHANGES/0.5 ARC-SEC.
- 3-D TEMPERATURE PROFILES EFFECT 32 - 42μRAD. $\sim$ 1%.
- AXIAL GRADIENTS COMPENSATE WEDGE/RADIAL GRADIENTS.
- INDEPENDENT GRADIENT TYPES HAVE FAIRLY HIGH SENSITIVITY.

RECOMMENDATIONS-ADDITIONAL EFFORT

(DEPENDENT UPON CUSTOMER/INVESTIGATOR NEEDS)

- TEST CORRELATION
  - SPECIFIC CORNER ANGLES/GEOMETRY
  - TEST EQUIPMENT EFFECTS
  - INTERFEROMETRIC/PHOTOMETRIC INPUT
  - FIELD ANGLE/APODIZATION REFINEMENT
  - INCIDENT WF QUALITY
  - FAR FIELD INTENSITY CROSS CHECKS
- ALTERNATE λ'ɛ, TREATMENT OF ARRAYS/POL. VARIATIONS
- "TRANSFER FUNCTION" SUPPORT

1.5 ARC SEC CORNER
ENCIRCLED ENERGY IN THE
32-42 MICRORADIAN RANGE

CASE	% ENERGY 32-42μ RAD ON AXIS	FULL
NOMINAL CUBE	21.6	10.8
NOMINAL CUBE +λ/4	21.2	9.8
NOMINAL CUBE +λ/4 +30°C CAVITY	20.4	9.4
NOMINAL CUBE +λ/4 +(-)30°C CAVITY	21.1	
NOMINAL CUBE +λ/4 + EST. MAX.	20.2	
OFF NOMINAL CUBE +λ/4	20.8	9.8
OFF NOMINAL CUBE +λ/4 + 30°C CAVITY	20.0	9.2
NOMINAL CUBE +λ/4 + AXIAL GRAD.	18.0	
NOMINAL CUBE +λ/4 + RADIAL GRAD.	5.1	

2.1 ARC-SEC CORNER

ENCIRCLED ENERGY IN THE

32-42 MICRORADIAN RANGE

CASE	% ENERGY 32-42μ RAD ON AXIS	FULL
NOMINAL CUBE	14.9	7.3
NOMINAL CUBE +λ/4	13.3	6.9
NOMINAL CUBE +λ/4 + 30°C CAVITY	12.3	6.2
NOMINAL CUBE +λ/4 + (-)30°C CAVITY	14.4	
NOMINAL CUBE +λ/4 + EST. MAX.	13.8	
OFF NOMINAL CUBE +λ/4	13.6	6.9
OFF NOMINAL CUBE +λ/4 +30°C CAVITY	12.5	6.2
NOMINAL CUBE +λ/4 + AXIAL GRAD.	19.8	
NOMINAL CUBE +λ/4 + RADIAL GRAD.	1.2	